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1981 Buffalo, New York Area Sediment Survey (BASS)

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16. ABSTRACT

The purpose of this report is to present the analytical results of the organic and inorganic findings from 103 sediment survey sites. The Buffalo New York area contained within the survey is a heavily contaminated area. Almost all of the 66 sites analyzed contained sediments which exceeded USEPA-Region V classification of heavily polluted for conventional contaminants and/or metals. Insufficient benthic living organisms were found in any of the sediments collected to permit analysis for contaminants.

Organic substances in this survey which were, "identified" and "quantified" by GC/MS to have concentrations of 5ppm or greater, contained nine potential or positive carcinogens and eight substances having a potential for chronic aquatic toxicity. The carcinogenic toxicants are: anthracene, benzo(a)anthracene, benzo(a)pyrene, chlorotoluene, fluoranthene, fluorene, phenanthrene, pyrene, and tetrachlorobenzene. The aquatic toxicants are: acenapthene, p-tert-butyl phenol, chlorobenzene, chloronaphthalene, di-n-butylphthalate, dichlorobenzene, pentachlorobenzene, and trichlorobenzene.

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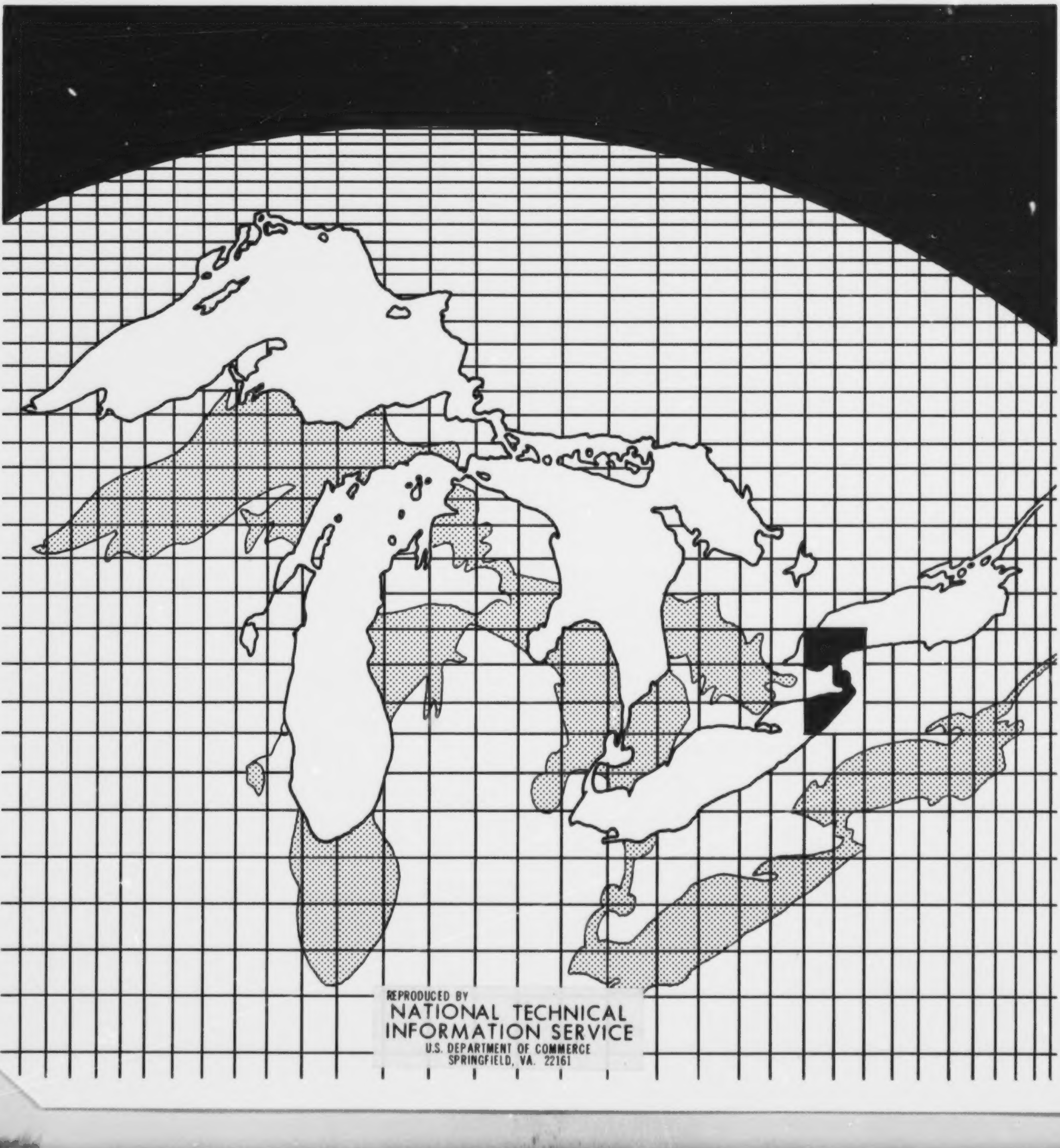

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1981 Buffalo, New York, Area Sediment Survey (BASS)

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FOREWORD

The Great Lakes National Program Office (GLNPO) of the United States Environmental Protection Agency was established in Region V, Chicago, to focus attention on the significant and complex natural resource represented by the Great Lakes.

GLNPO implements a multi-media environmental management program drawing on a wide range of expertise represented by universities, private firms, State, Federal, and Canadian governmental agencies, and the International Joint Commission. The goal of the GLNPO program is to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin ecosystem and to eliminate or reduce to the maximum extent practicable the discharge of pollutants into the Great Lakes system. GLNPO also coordinates U.S. actions in fulfillment of the Agreement between Canada and the United States of America on Great Lakes Water Quality of 1978.

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Conclusions and Main Findings

In 1981, Great Lakes National Program Office (GLNPO) collected sediments from the Buffalo area (Figure 1). During May 5 and 6, sediments were taken from 93 sites (Appendix A, Table 1 and Appendix A, Figures 1-3). On September 3 eleven samples were collected at 10 sites (Appendix A, Table 2 and Appendix A, Figures 1-3). Appendix A contains the field notes from both May and September field work.

The Buffalo area contained within the survey is a heavily contaminated area (Figure 1). Almost all of the 66 sites (Appendix A, Figures 1-3 and Tables 1-2) analyzed contained sediments which exceeded USEPA Region V classifications of heavily polluted for conventional contaminants and/or metals (Appendix B, Table 1). Only sites 3 and 91A did not have at least one conventional contaminant or metal parameter at a concentration that would qualify as heavily polluted (Table 1) by EPA's dredging disposal criteria. Insufficient benthic living organisms were found in any of the sediments collected to permit analysis for contaminants.

The organic, inorganic, and conventional pollutants identified in this study were categorized to ease the data analysis. The sites that emerge having at least four or more categories of contaminants at the highest levels were site 12 (8 categories), site 58 (4 categories), and site 72 (4 categories) (Table 1). Appendix C contains the analytical results. Appendix D contains a map of the site locations of heaviest contamination. Site 12 was sampled during both survey runs (total of four times), a contributing factor to its apparent high degree of contamination. There are fourteen sites for which pollutants belonging to three or more different categories were identified, and for which these pollutants were quantified at levels sufficiently high to classify the sites as "heavily polluted."

Figure 1

Buffalo, New York
1981 Sediment Survey Area

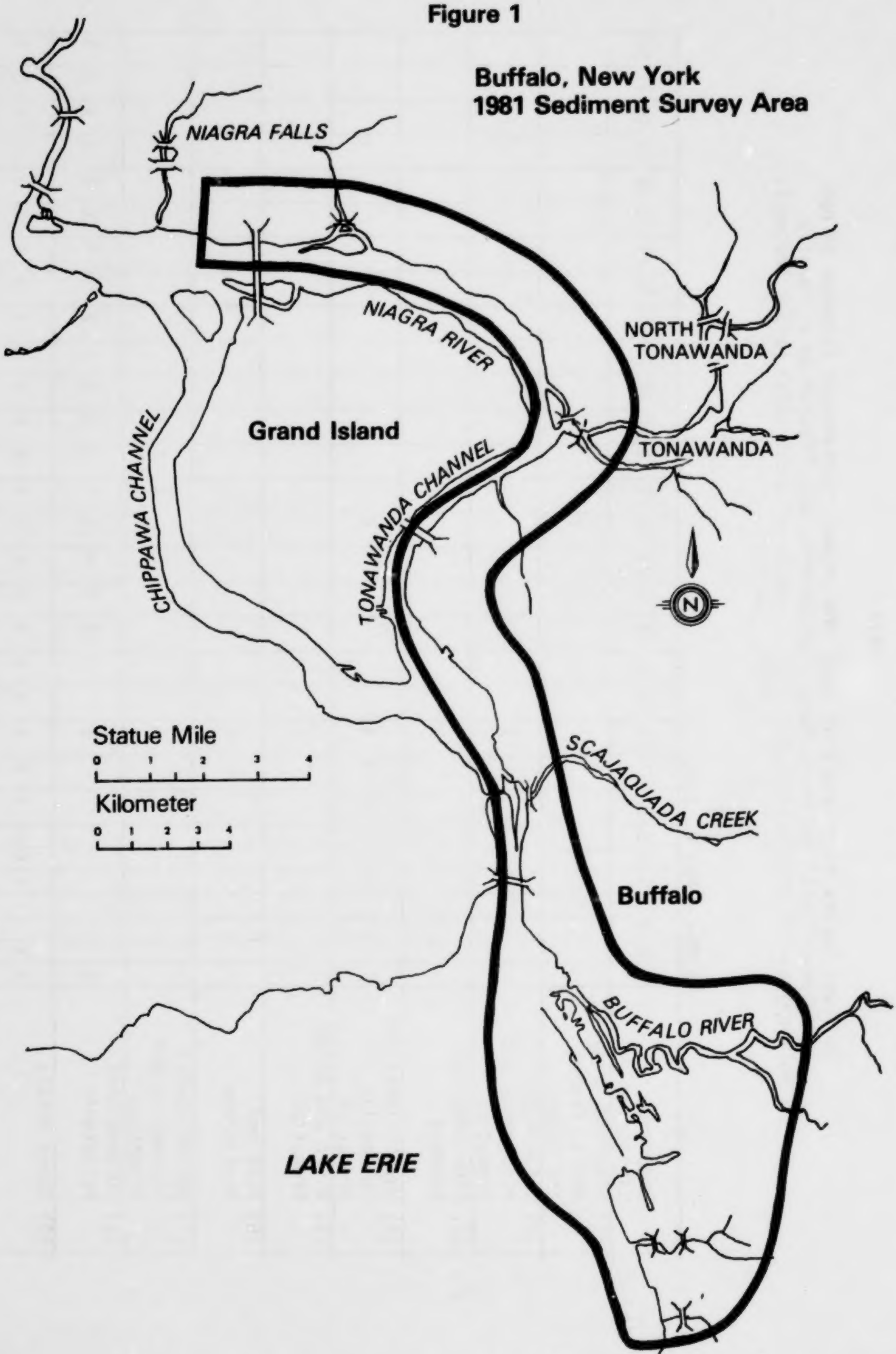

NIAGRA FALLS
NIAGRA RIVER
NORTH TONAWANDA
TONAWANDA
Grand Island
CHIPPAWA CHANNEL
TONAWANDA CHANNEL
N
Statue Mile
0 1 2 3 4
Kilometer
0 1 2 3 4
SCAJAQUADA CREEK
Buffalo
BUFFALO RIVER
LAKE ERIE

Table 1

Sediment Survey Sites Where at Least One Organic Contaminant Exceeded 50 ppm or Conventional and Heavy Metal Contaminants Were Classified as Heavily Polluted by EPA 1977 Pollutional Classification of Great Lakes Harbor Sediments
Buffalo, New York

	Sites - May 6, 1981																													
Compound Categories	1	2	3	4	5	7	8	10	11	12	13	16	19	22	24	26	27	31	32	33	35	37	40	41	43	44	45	48	51	52
(1) Alcohols, Organic Acids, Ethers and Esters				X												X														
(2) Chlorinated Aliphatics and Aromatics										X																				
(3) Aldehydes and Ketones										X																				
(4) Naphthalenes and Polycyclic Aromatics					X			X	X	X						X														
(5) Nitro and Amino Aromatics										X																				
(6) PCBs and Pesticides									X	X																				
(7) Unsubstituted Aliphatics and Aromatics										X							X	X	X						X		X			
(8) Conventional Pollutants	X									X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(9) Heavy Metals	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 1, cont.

Compound Categories	Sites - May 6, 1981																											
	53	54	55	56	57	58	59	60	61	65	66	67	70	71	72	73	75	76	78	81	82	83	86	87	89	90	92	95
(1) Alcohols, Organic Acids, Ethers and Esters																												
(2) Chlorinated Aliphatics and Aromatics																												
(3) Aldehydes and Ketones																												
(4) Naphthalenes and Polycyclic Aromatics			X	X		X									X	X											X	
(5) Nitro and Amino Aromatics																												
(6) PCBs and Pesticides																												
(7) Unsubstituted Aliphatics and Aromatics						X			X			X			X	X				X	X			X				
(8) Conventional Pollutants	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X			X	
(9) Heavy Metals	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 1, cont.

	Sites - September 3, 1981							
Compound Categories	12	74 A	74 B	80 A	87 A	91 A	91 B	91 C
(1) Alcohols, Organic Acids, Ethers and Esters								
(2) Chlorinated Aliphatics and Aromatics	X							
(3) Aldehydes and Ketones	X					X	X	
(4) Naphthalenes and Polycyclic Aromatics	X							
(5) Nitro and Amino Aromatics	X							
(6) PCBs and Pesticides	X							
(7) Unsubstituted Aliphatics and Aromatics	X							
(8) Conventional Pollutants	X		X		X			X
(9) Heavy Metals	X	X	X	X	X		X	

Organic substances in the Buffalo area sediments, "identified" and "quantified" by GC/MS to have concentrations of 5 ppm or greater, contained nine potential or positive carcinogens and eight substances having a potential for chronic aquatic toxicity. The carcinogenic toxicants, and the numbers of sites at which they were found, are as follows: anthracene (19), benzo(a)anthracene (34), benzo(a)pyrene (12), chlorotoluene (1), fluoranthene (28), fluorene (1), phenanthrene (2), pyrene (20), and tetrachlorobenzene (1). The aquatic toxicants, and site numbers at which they were found, are as follows: acenapthene (2), p-tert-butyl phenol (1), chlorobenzene (1), chloronaphthalene (1), di-n-butylphthalate (3), dichlorobenzene (5), pentachlorobenzene (1), and trichlorobenzene [1,2,4] (1). The sites where these compounds were found can be identified by referring to Appendix E.

It should be remembered that GC retention time, even with capillary columns, is not a confirmation of compound identity. Analysis by at least semi-quantitive (order-of-magnitude) GC/MS is required for confirmation. If GC/EC and GC/MS quantifications do not compare in the Pesticide/PCB determinations, the more sensitive dual column GC/EC data is used.

Further study of this area is continuing in support of remedial efforts. The Niagara River Toxics Committee is exchanging information on the United States and Canadian remedial program and need for further environmental studies. The membership of this committee is drawn from the United States and Canada. The members include representatives from United States Environmental Protection Agency, the New York Department of Environmental Conservation, the Ontario Ministry Of Environment, and Environment Canada.

Introduction

This sediment survey is one in a series of Great Lakes National Program Office studies designed to define the environmental state of the harbors and rivers on the Great Lakes. The scope of this report consists of evaluating the available data from the Buffalo, New York area (Figures 1, Appendix A - Figures 1-3 and Tables 1 and 2) and primarily focuses on the extent of toxicant contamination in the subject area (Appendix C- Analytical Results). Appendix A contains the field notes associated with all sites visited. The report does not consider Buffalo area water quality since the water solubility of the toxicants, both organic and metallic, is low. Nor are the Buffalo area pollutional effects upon the Niagara River and Lake Ontario considered. Recent improvements in analytical techniques now make it possible to detect some chemical substances at very low levels, well below the levels at which the substances might cause harmful environmental effects. Due to the paucity of known environmental effects, sites are evaluated in this report with respect to elevated levels of measured substances within the area. Thus, because a site is identified as containing elevated contaminant levels, it is not necessarily a hazardous site, although it becomes a site of concern requiring further evaluation.

Background - Historical Data Collection Activities in the Buffalo Area

Early sediment sampling of Buffalo Harbor and the Black Rock Canal was conducted by the U.S. Environmental Protection Agency (USEPA) in 1967, 1969, 1970, and 1972. Sediment analyses were conducted in 1967 and 1969 for volatile solids, chemical oxygen demand, total nitrogen, and oil and grease. In 1970, tests were conducted for mercury. According to the 1972 USEPA Report, all sediments tested through 1969 were grossly polluted. In 1972, USEPA tested for the same parameters previously listed and conducted additional analyses for lead and zinc. Tests were performed at 11 stations throughout the Federal channels. The conclusion reached by USEPA for the 1972 sediments was that they were still grossly polluted although levels of pollution had decreased since 1970 (Bennett 1982).

Other organizations have conducted studies in the Buffalo area. A brief summary of published results are given.

Canada-Ontario Review Board has published two reports which focus on water quality problems resulting from inadequate control of toxic substances as evidenced by their presence in the Niagara River and Lake Ontario [Canada-Ontario Review Board (1980,1981)]. All bottom sediment samples from the lower Niagara River had concentrations of total PCBs exceeding the 50 ppb MOE criteria for confined disposal of dredged spoils (Canada-Ontario Review Board 1981).

The Canadian Centre for Inland Waters has sampled bottom sediment for the upper and lower Niagara River for metals and toxic organic contaminants (Kuntz 1981, in press). The 1979 and 1981 bottom sediment samples are reported on. From these data, the Buffalo River, The Black Rock Canal or Scajaquada Creek, Two Mile Creek, Ellicot Creek (or the Erie Canal) and the Love Canal area are or have been sources of many of these contaminants to the Niagara River. Most of the areas of concern mentioned above contain sediments which exceed the MOE dredge spoil criteria for disposal of these sediments. These sediments all fall into the USEPA Region V classification of heavily polluted sediments for most of these contaminant parameters. Therefore, disposal of these dredge spoils must be contained and not dumped into Lake Erie.

Work directed toward determining the fate of organic chemicals in the Niagara River and the Buffalo River has been reported on.

Water and sediment samples were taken from sites adjacent to hazardous waste disposal areas in Niagara Falls, New York. The samples were analyzed by GC/MS. The following compounds were identified: chlorobenzenes, chlorotoluenes, polycyclic aromatic hydrocarbon derivatives, PCBs, trichlorophenol and other phenols, benzyltrifluorides, mirex, and phenothiazine. A large number of benzyl derivatives and a few unusual fluorinated compounds were also found; they were probably waste byproducts of the industrial chemical production of benzyl chloride and chloro(trifluoromethyl)benzene, respectively. The hazardous waste disposal sites were the major sources for most of the compounds which were found. The biological and environmental fates of these compounds were not evaluated (Elder, et al 1981).

Three sediment samples taken from the Buffalo River and two soil samples taken near its bank have been analyzed for 2-propanol-extractable, basic organic compounds by using GC/MS. Eleven aromatic amines related to the commercial production of malachite green and crystal violet were identified in both the sediment and soil samples. Apparently a dye manufacturing plant used this part of the river bank as a dump, and several of its waste chemicals were leached into the river. It is possible that the compounds reported here are, at least partially, responsible for tumors observed in fish taken from this river (Nelson and Hites 1980).

The US Army Corps of Engineers surveyed the Buffalo area in 1981. Significant organic contamination of the Buffalo River, Buffalo River Harbor, and Black Rock Channel sediment quality was found. Confinement of the dredge sediments from these Federal navigation channels should be continued as an alternative to open lake disposal (Pethybridge 1981).

Methodology

The site locations were designed by determining and plotting on a large scale map the location of sewage treatment plant discharges, combined sewer discharges (particularly those carrying industrial waste), industrial discharges and any other feature that might result in contaminated sediments. To this was added any data on sedimentation patterns that may exist from dredging records, and existing data on sediment quality. This information was used to identify locations where contaminated sediments were most likely to exist.

Two categories of sampling sites were selected. Primary sites were sites that were most likely to be contaminated and all primary sites samples were to be scanned and run for specific compounds which are known to be used in the area or have been found in fish from the area. Secondary sites are sites which will be run if the primary sites indicate a significant problem exists and will be used to define the extent of the problem. Secondary samples would only be analyzed for the specific compounds indicated as problems at primary sites. Compounds for specific analysis at primary sites will be selected based on data from fish and from data on industrial and agricultural usage in the area.

Due to laboratory resource constraints not all primary sites could be analyzed. Based upon field records, quantity of sediments, benthos, and potential sources, those sites which appeared to be the "worst" were selected for analysis. Samples from the remaining sites were logged, preserved, and stored for future analysis should additional data be required.

Sediment samples were collected in the manner described in the Methods Manual for Bottom Sediment Sample collection (USEPA 1977). Grab samples were retrieved in May using a Ponar (clam shell) dredge for both the chemistry and benthos analysis. Core samples were taken in September using a Wildco brass core tube 20" long with a 2" inner diameter and clear lexon plastic liner tube. For the benthos analysis, the sediment samples were strained through a 80 mesh sieve (U.S. Standard) and any invertebrates were picked off the sieve with a tweezer, transferred to a sample jar and preserved with 70 percent ethanol. The sediments for chemistry analysis were preserved by refrigeration to 4°C.

Prior to non-volatile organic analysis, the sediment samples were allowed to thaw to 15-25°C. Each sample was manually mixed and allowed to air dry. All samples were ground with a mortar and pestle. Any sample requiring further homogenization (discretion of analyst) was then passed through a 20 mesh polypropylene sieve. The percent solids of the sample was determined on a separate aliquot dried at 103-105°C.

The presence of a broad range of volatile and semi-volatile organic contaminants, (see Appendix C, Tables 1 and 2 respectively) was determined by subjecting the sediments to GC/MS scans. The semi-volatile organics were removed from the sediments by Soxhlet extraction with a 1:1 mixture of acetone and hexane. A portion of the extract was passed through Florisil column chromatography. The extract from the first chromatographic fraction was then passed through silica gel to further separate the PCBs from the pesticides. The fractions were analyzed by dual column GC/EC. Volatile organic analysis was done on wet sediment diluted with organic free water. Concentration is later corrected for percent solids and reported on a dry weight basis. The sediment and dilution water was purged with helium and the volatile organics were trapped on Tenax. The trap was desorbed onto the GC column of a Hewlett-Packard 5985 GC/MS. Organic contaminants quantitatively identified on the GC/EC scans were confirmed using GC/MS. All GC/MS scans and specific GC analyses followed USEPA standard procedures for dealing with priority pollutants. (Methods 608, 624, 625 Federal Register 1979).

Quantification of PCBs and pesticides (Appendix C - Table 3) was determined by subjecting the sediment extracts to gas chromatography with electron capture detector (GC/EC). Samples were air dried and sieved. Organic components were removed from 20 grams of sample using Soxhlet extraction of 16 hours with a solvent consisting of a 1:1 acetone/hexane (V:V) mixture. The extract was concentrated and partitioned through Florisil for the elimination of interferences and separation of various pesticide mixtures. Further separation of PCBs from pesticide components was done with silica gel. Quantitative determination and confirmation was done using dual column GC/EC on the extracts. The GC/EC extracts were also analyzed by GC/MS for additional confirmation.

All quantification of pesticides/PCBs is by the dual column method. This requires that the chromatographic peak for the compound in question appears on both columns at the appropriate retention times. Quantitation for pesticides is by the internal standard method using p, p'- DDT for the "D" fraction and Mirex for the "F" fraction (Appendix F), while the external standard method using actual Aroclors is used for PCB quantitation. The internal standard method requires that the peak area for each routinely determined pesticide be compared to the peak area of one compound (the internal standard) to obtain ratios (relative response factors) which can be used to quantitate the amounts of pesticides present in samples. A known amount of this internal standard is then added to each sample. This procedure minimizes variations in detection response and sample handling technique. Relative response factors for all routinely determined pesticides and Aroclors are recalculated for each new batch of samples by the use of actual reference compounds which are available in the laboratory.

Quantitation by GC/MS depends on whether a definite compound assignment, or only a tentative or unknown assignment, can be made. Definite compound assignments are reported only when the retention time data and mass spectral data indicate that the compound is present, and when an authentic reference compound is available for comparison purposes. Quantitation is by the internal standard method using D-10 phenanthrene. Relative response factors are determined for each new batch of samples using the actual reference compounds which are available in the laboratory. Actual reference compounds are available for all priority pollutants, as well as for many other commonly found chemicals.

Tentative compound assignments are reported when there are significant spectral matches between the mass spectrum of the compound searched and the reference spectrum in the computer library. The similarity index computation is part of the software of the Hewlett Packard computer library search program. A manual review is also made of all library searches to assure that the library results are sufficient for the tentative identifications. However, further confirmation is not possible because an authentic reference compound is not available. It is therefore not possible to quantify how sure the identification is. In addition, the estimated concentrations of these tentatively identified compounds are qualitative since the authentic compounds are not available from which to obtain the response factors necessary for internal standard quantitation.

Unknown compound assignments are reported when there are no credible spectral matches between the spectra under consideration and the entire computerized spectral library. Only estimates of concentration are possible since the response factor necessary for quantitation are not known.

Heavy metals were determined by first digesting the sediment samples in a mixture of hot concentrated acids. (The specific mixture depends upon the analyte.) The acid extracts were analyzed for mercury using an automated cold-vapor atomic absorbtion technique. Arsenic and selenium were determined using the hydride generation method. In addition, a scan for over 20 metals was made using Inductively Coupled Argon Plasma (ICAP) techniques (Appendix C-Table 4).

The following seven determinations of conventional pollutants were run on all sediments. Appendix C-Table 5 contains the results of these determinations.

Chemical Oxygen Demand (COD).

COD was determined based on a silver sulfate catalyzed reaction with potassium dichromate. A homogenized, acidified wet sediment sample was mixed with a potassium dichromate solution containing silver sulfate, sulfuric acid and mercuric oxide. The mixture was refluxed for 2 hours and then analyzed using an automated spectrophotometric method based upon the determination of the concentration of Cr^{+3} which is proportional to the COD.

Cyanide.

Cyanide is converted to HCN by means of a reflux-distillation catalyzed by copper chloride which decomposes metallic cyanide complexes. The HCN gas that is produced is then absorbed in a NaOH solution which is then analyzed using the automated pyridine-barbituric acid spectrophotometric method. Cyanide concentrations are reported as mg CN^-/kg dry sediment.

Water samples are analyzed using similar procedures outlined in USEPA 1979b. Concentrations are given as mg/l.

Phenol.

Manual distillation of phenolic compounds was used to remove interferences. The distillate was then analyzed using an automated spectrophotometric method based upon the buffered ferricyanide-catalyzed reaction of phenol with 4-aminoantipyrene. Phenol concentrations in the sediment are reported as mg/kg dry sediment while water analysis following similar procedures (USEPA 1979b) is reported as mg/l.

Total Phosphorus and Total Kjeldahl Nitrogen

For total phosphorus and total Kjeldahl nitrogen analysis, samples were digested at 370° in a block digestor using a Hg-catalyzed K_2SO_4/H_2SO_4 digesting solution. The digestion converted organic nitrogen and phosphorus compounds to ammonia and orthophosphate, respectively. The digested samples were then analyzed for NH_3 and PO_4 using an automated spectrophotometric method. The NH_3 determination was based upon the nitroprusside-catalyzed indophenol blue reaction. The PO_4 determination was based upon the ascorbic acid-reduced molybdenum blue heteropoly reaction.

Waters were analyzed according to USEPA 1979b using the Technical AA II system. Results are in mg/l Phosphorus.

% Solids.

A known weight of homogenized, moist sediment was dried at 105°C. The total solids are calculated as:

$$\% \text{ Solids} = \frac{\text{dry weight g}}{\text{wet weight g}} \times (100\%)$$

Volatile Solids.

Volatile Solids were determined by igniting the dried residue from the total solids determination at 550°C for one hour. The weight loss on ignition is used to calculate % volatile solids. Volatile solids were expressed as a percentage of the total solids in the sample.

All metals and organic contaminants were reported as milligrams per kilogram (ppm) dry weight. Quality assurance procedures set variance limits for reference samples, sample splits, and spike samples. Any results obtained outside USEPA acceptance limits were flagged as out of control and the samples rerun, if possible.

More detailed descriptions of the methodology for sediment analysis can be obtained from USEPA Region V, Central Regional Laboratory, 536 S. Clark Street, Chicago, Illinois 60605. Appendix F contains sediment analysis description in some detail. A brief summary of methods is shown in Appendix F Table 1. Appendix F Table 2 contains a summary of approximate precision, accuracy and detection limit in sediments for the analysis contained in this report. It should be noted that due to the inherent lack of homogeneity in the sediment samples, there are wide variations in the precision and accuracy of the GC/MS semi-volatile analysis and the GC/EC, PCB, and pesticide analysis.

Results

The objective of this report is to select, amongst the sites analyzed, the most heavily contaminated locations across a broad spectra of pollutants. The method selected resulted in nine categories of compounds being used in the evaluation. These categories were divided so that there were seven categories of organic contaminants and two categories of conventional pollutants, including metals.

The latter two categories have been used to characterize harbor sediments being considered for dredging and potential open lake disposal (Appendix B - Table 1). All sites analyzed had sediments containing some parameters which were moderately or heavily polluted using the 1977 EPA sediment disposal guidelines established for disposal of dredged material in the lake. Those sites, containing at least one conventional or metal pollutant classified as heavily polluted, are given in Table 1, Categories 8 and 9).

In addition to these conventional or metal pollutants, all sites had measurable levels of organic contaminants for which no sediment guidelines have been established regarding their hazard potential. There is a presumption of health concerns regarding the presence of some organic compounds in sediments. Correlations between sediment concentrations of polycyclic aromatic hydrocarbons (PAHs), the incidence of neoplasms in bottom dwelling fish, and induction of neoplasms in a bottom feeding fish species, brown bullhead (Ictalurus nebulosus), by direct exposure to extracts of polluted river sediments supports the hypothesis that some fish neoplasms result from exposure to carcinogenic chemicals present in the fish's environments (Black 1982).

To select sites where the highest levels of organic contaminants were found, across broad categories of organics, the following approach was arbitrarily selected. To reduce the number of organic compounds to a manageable size an arbritrary level of 5 ppm was selected (Appendix F). Compounds which exceeded 5.0 ppm at least one sample site were grouped into nine categories: (1) Alcohols, Organic Acids, Ethers, and Esters, (2) Chlorinated Alipahtic and Aromatic Hydrocarbons, (3) Aldehydes and Ketones, (4) Naphthalenes and Polycyclic Aromatic Hydrocarbons (PAH), (5) Nitro and Amino Aromatic Hydrocarbons, (6) PCBs and pesticides, (7) unsubstituted Aliphatic and Aromatic Hydrocarbons, (8) Phenols, (9) Polyalicyclic Hydrocarbons. Of these categories, seven categories (1-7) emerged with at least one organic compound that equalled or exceeded 50 ppm. Only the Phenol category and the Polyalicyclic Hydrocarbons category failed to include compounds equalling or exceeding 50 ppm at at least one sample site.

Agreement between parallel analyses by GC/EC and GC/MS is uneven. The sample shown by GC/EC to be most heavily laden with PCBs (NS01S99) gave a very weak response in the GC/MS test. The sample shown by GC/EC to be most contaminated by Mirex (NS02S11) gave no noticeable response to GC/MS. This kind of discrepancy is also seen with di-n-butyl phthalate, DDT, and zytron. These results are not unexpected.

The electron capture detector, used in the gas chromatographic analysis of pesticides and PCBs, is very sensitive to halogen containing organic compounds. It is 10-100 times more sensitive than the mass spectral source of the GC/MS which is why it is the preferred method for the quantitative determination of pesticides and PCBs. GC/MS confirmation of GC/EC results can only occur if the pesticide or PCB level in the extract is equal to or greater than the detection limit of the mass spectral source. The detection limit for a particular compound will vary from sample to sample since other compounds in the sample being studied can interfere or mask the spectrum of interest (matrix effect). Appendix F, Table 3, gives organic compounds sought and representative detection limits.

The presence of Mirex (NS01S89, NS02S11), Zytron (NS01S00), three Aroclors (NS01S99) and four pesticides (NS03S66) were reverified from the GC/EC data. The GC/MS did not confirm the presence of these compounds either through manual search or multiple ion monitoring indicating that their level was below the M.S. detection limit. The presence of Mirex in sample NS01S78 was also reverified from the GC/EC data. However, although the Quantid Program indicated the possible presence of Mirex, no mass spectral proof was obtained.

The presence of di-n-butylphthalate in sample NS03S66 appears to be due to laboratory contamination. Butylphthalate was not found in the duplicate NS03D66, nor was evidence found by GC/MS for the presence of this compound. Because di-n-butylphthalate is not a pesticide or PCB, GC/EC determinations require much more laboratory manipulation than GC/MS work, and thus are more susceptible to laboratory contamination, the quantitation of di-n-butylphthalate done by GC/MS is used for the determination of all other phthalates. The GC/EC data are reported for completeness. Di-n-butylphthalate was added to the GC/EC spike mixture to assure that its presence did not interfere with the determination of other pesticides and PCBs.

The choice of 5.0 ppm as a "cut off" concentration level for further consideration of organic substances was based upon a cursory inspection of the data followed by a crude statistical interpretation of observations made. The first observation was that the polyaromatic hydrocarbons (PAHs) appeared to be the most well-represented group, in terms of the number of different compounds. They also represented the typical concentration levels of all of the compounds found. It also appeared that roughly 5.0 ppm might represent an approximate median level for many of the PAHs. The exact medians of the following PAHs test the validity of assuming 5.0 ppm as an median value:

Anthracene/Phenanthrene	2.3 ppm
Pyrene	5.35 ppm
Benzo(a)Anthracene/Chrysene	11.25 ppm
Fluorene	0.85 ppm
Fluoranthene	5.6 ppm

The "cut off" value of 5.0 ppm was selected for other categories because it was felt that any compound was worthy of consideration if detected at levels exceeding the apparent median value of compounds in the largest chemical grouping, i.e. the PAHs.

The sediment sites of concern were selected on the basis of a 50.0 ppm limit. This value was felt to approximate the 90th percentile of many of the PAHs. Any compound analysis exceeding this assumed 90th percentile for PAH was deemed sufficient justification for labeling the corresponding sample site a "worst" site with respect to that particular compound's chemical grouping. The actual 90th percentiles for the following PAHs test the validity of the 50 ppm assumption:

Anthracene/Phenanthrene	10.6 ppm
Pyrene	20.0 ppm
Benzo(a)Anthracene/Chrysene	52.5 ppm
Benzo(a)Pyrene	89.0 ppm
Fluoranthene	19.0 ppm

The use of the 50 ppm concentration provided a crude prioritization amongst the sites analyzed for toxicant contamination. Table 1 contains the sites where at least one organic compound in the categories 1-7 was found to exceed 50 ppm. It should be emphasized that the contaminant levels selected, in order to characterize the sediments with respect to their organic contaminants, are completely arbitrary. At this time not enough is known about the health significance of these contaminants or enough about the mechanism of their release or bioavailability from sediments. The emergence of a particular compound which may be toxic or carcenogenic at concentration levels lower than the 50 ppm selected would have a profound effect on the crude priority scheme developed here.

Additional analysis was done at USEPA's Environmental Research Laboratory in Duluth (ERL-D), Minnesota, for Buffalo River sediment samples (see credits).

The mass spectrometry group at ERL-D examined Buffalo River sediments for unusual observations, i.e., very high levels of a specific chemical or the identification of chemicals not routinely observed in environmental samples. These analyses were done by capillary column electron capture gas chromatography using a 60m x 0.25 mm SE-54 fused quartz column with hydrogen as a carrier gas to optimize resolution.

The analysis of planar molecules follows the methods reported in "Analysis of Molecules in Planar Conformation in Great Lakes Fish" (Kuehl, Butterworth and Durhan, 1982). Briefly, the sample (50g sediment) is soxhlet extracted with 500 ml hexane/CH_2Cl_2 (1:1) or hexane/acetone (1:1), respectively, for 24 hours. The samples are then reduced in volume to 5 ml and chromatographed on a sulfuric acid (Baker ultra high purity)/celite 545 column coupled to a 1.0g column of cesium silicate by eluting with 200 ml hexane. This procedure oxidizes biological molecules and removes polar chemicals. The sample is again reduced in volume to 5 ml and adsorbed on a column of 50 mg amoco PX-21 carbon on glass fibers (1 cm x 4 cm). This column is washed with 50 ml CH_2Cl_2 to remove non-planar chemicals. Planar molecules are removed initially by washing with 50 ml CH_2Cl_2/Benzene (1:1, FRA #1), which contains predominantly planar PCBs. Planar molecules more tightly bound to the carbon are removed by washing with 50 ml toluene in the reverse direction. The toluene fraction is then fractionated on basic alumina into two fractions, one containing chloronaphthalenes (FRA #2) and a second containing chlorinated dibenzo-p-dioxins, and dibenzofurans (FRA #3). Blanks, recovery studies, and surrogate spikes were used to assure a detection limit of 10 ppt based upon 1,2,3,4-TCDD.

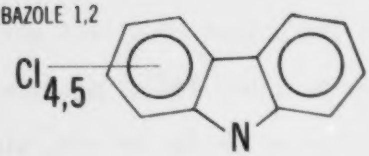
The 50g sediment sample was a composite of Buffalo River sediment NS01S55, NS01S79, and NS03S66 (1:1:1). The sediment samples were very complex. First, the three fractions were dominated by dichloro- through hexachlorobenzenes, dichloro- through heptachloronapthalenes, and trichloro- through octachlorodibenzofurans. No PCDDs were observed. A series of halogenated planar molecules not previously identified in environmental samples have been tentatively identified. Their identification is based upon chromatographic elution patterns and mass spectral data. Authentic standards are not available to verify identifications. A summary of all the non-PCB planar chlorocarbons identified are shown in Table 2. The range of concentrations for all chemicals except chlorobenzenes are 10-500 ppt.

In addition, an attempt to isolate and identify at least one of the color dyes in one of the sediment samples was made. Sample NS03S66, identified as

Table 2

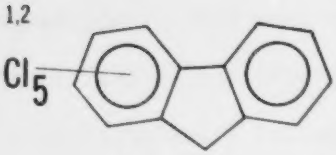
9H-CARBAZOLE 1,2

I



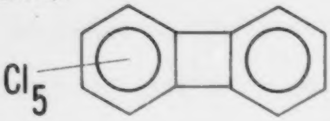
FLOURENE 1,2

II



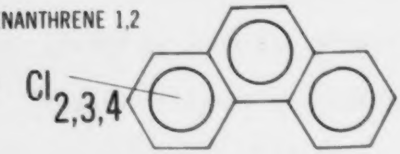
BIPHENYLENE 1,2

III



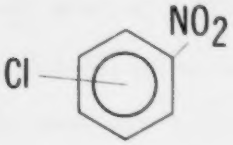
PHENANTHRENE 1,2

IV



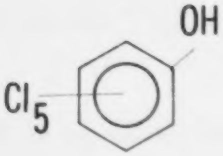
NITROBENZENE

V



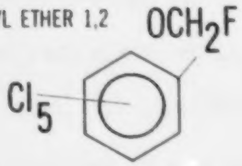
PHENOL

VI



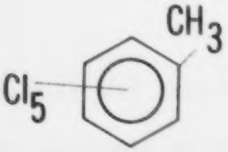
PHENYLFLUOROMETHYL ETHER 1,2

VII



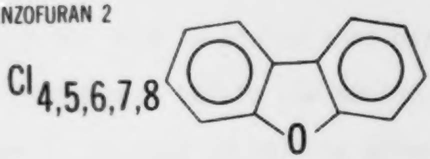
TOLUENE

VIII



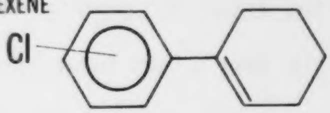
DIBENZOFURAN 2

IX



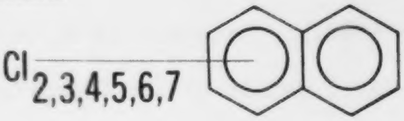
PHENYLCYCLOHEXENE [1]

X



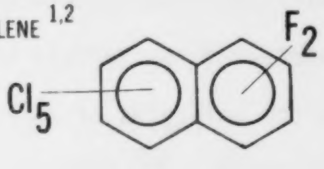
NAPHTHALENE [2]

XI



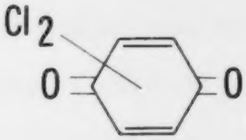
DIFLUORONAPHTHALENE [1,2]

XII



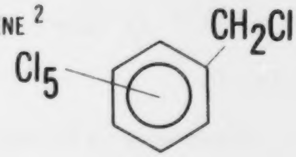
BENZOQUINONE [2]

XIII



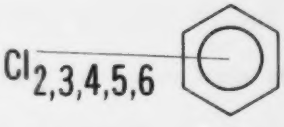
CHLOROMETHYLBENZENE [2]

XIV



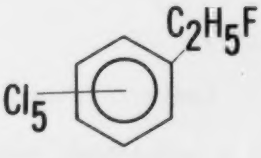
BENZENE

XV



ETHYLFLOUROBENZENE

XVI



Chlorinated planar molecules identified in Buffalo River sediments.

1. Not known to have been previously identified in environmental samples
2. Numerous congeners identified

Buffalo Color, was soxhlet extracted with acetone. The extract was concentrated to a volume of 1 ml and transferred to a 10g column of silica gel. The volume was eluted with 100 ml hexane, 100 ml benzene, 100 ml methylene chloride and 100 ml acetone. A very complex series of shades of red, blue, yello, green and purple color bands were eluted from the column; however, a single very tight band of royal blue remained stationary at the top of the column. The colored compound/silica gel mixture was transferred to a beaker. The color was washed from the silica gel with hot water and back extracted into CH_2Cl_2. Attempts to GC the sample were unsuccessful as expected.

As a result of the identification of a series of polychlorinated planar molecules similar in structure to chlorinated dibenzo-p-dioxins in sediment samples of the Buffalo River, New York, further work was done at ERL-D. One of the molecules of particular interest was tentatively identified as a tetrachloro-9H-Carbazole (TCC). TCC was found at higher concentrations than tetrachlorodibenzofurans (TCDF), and could possibly be more toxic than TCDF. Levels of TCDFs in these samples were estimated to be 100-500 ppt. These values were estimated by assuming that the relative response of the molecular ion of TCDF is equal to the response of TCDD. No TCDF standards are available at ERL-D.

Bioassays were run after syntheses and quantification of TCC were done at ERL-D. Two groups (30 day old and 3 day old) of 10 fathead minnows each were exposed for 10 days to 2 liters of sterilized water saturated with 1,3,6,8-TCC. No deaths were observed during this time. Therefore, TCC does not appear to be an acutely toxic chemical; however, it is predicted to be highly bioacccumulative.

Sediment sample NS03S66 from the Buffalo River, New York was analyzed for Mirex using high resolution gas chromatography with electron capture detection.

Mirex was not detected in the sediment sample. Procedural detection limits were calculated at 5 ppb in the sediment sample.

A sample bank and a 100 ppb spike sample were carried through the entire analysis with sediment samples. No Mirex was present in the blank above stated detection limits. Recovery of Mirex from the spike samples was 102%.

The sediment samples contained heavy amounts of a large number of compounds including a large peak with retention time of 49.00 minutes which could easily be mistaken for Mirex. The mean retention time of Mirex was 48.88 min (n = 13; SD = 0.01); maximum absolute deviation from the mean value was ± 0.02 min. Chromatograms are shown in Figure 2.

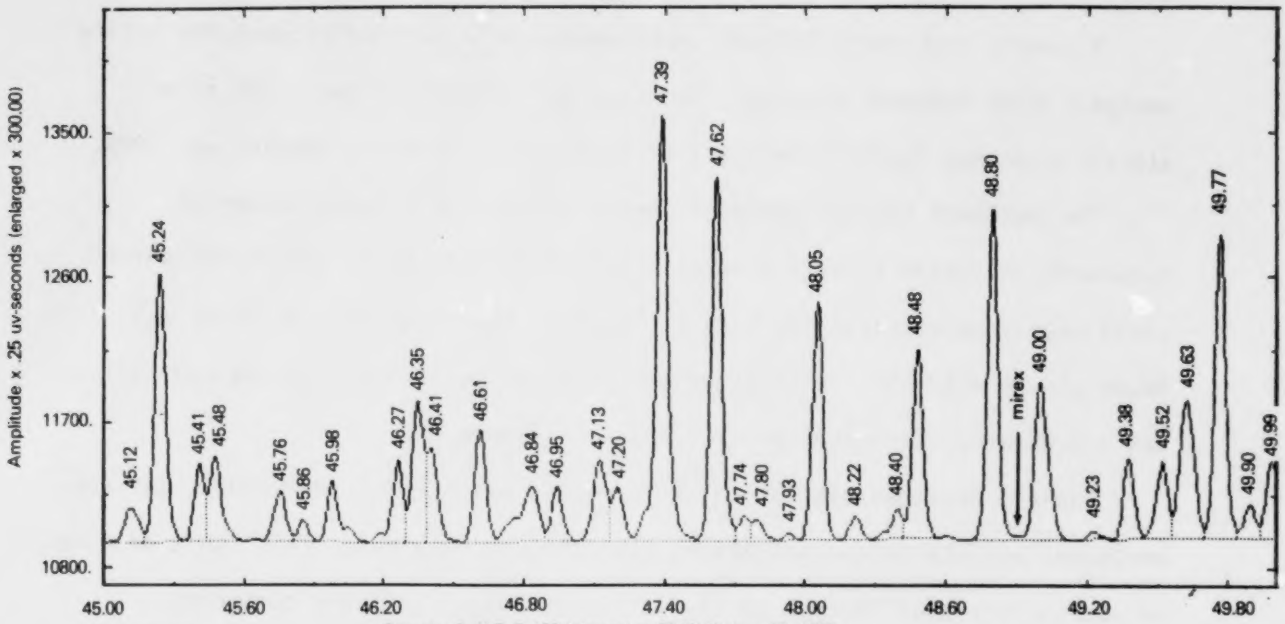
Table 3 provides statistical information using PCBs, pesticides, and conventional pollutants concentrations from the CRL data set. This table provides an approximate distribution of the values obtained for these compounds.

There is only one PCB and pesticide parameter with observations greater than 50 ppm. If a lower concentration was determined to be significant, then more sites would be identified as "worst" for the PCB and pesticide categories. Parameters which may be significant at lower levels have been suggested (Kizlauskas 1982). The parameters and their concentrations are as follows: Total PCBs >5 ppm; total DDT >1 ppm; hexachlorobenzene >0.1 ppm; and Mirex >.2 ppm; while one is at a higher level: mercury >2 ppm. The sites, where these PCB and pesticide parameters concentrations are exceeded, are as follows: PCBs (32, 72, 73, 82); DDT (12, 32, 73, 82); hexachlorobenzene (12, 72, 73); and Mirex (21, 92). The slightly higher mercury concentration level did not alter the evaluation of heavily polluted sites for the metal category. The pattern suggested by raising or lowering criteria concentration levels for a particular category may be valid. That is, more sites will be included if

Figure 2
Electron Capture (EC) Chromatograms

Buffalo River Sediments 20.0 g sediments
extracted at 100 ml. in isooctane

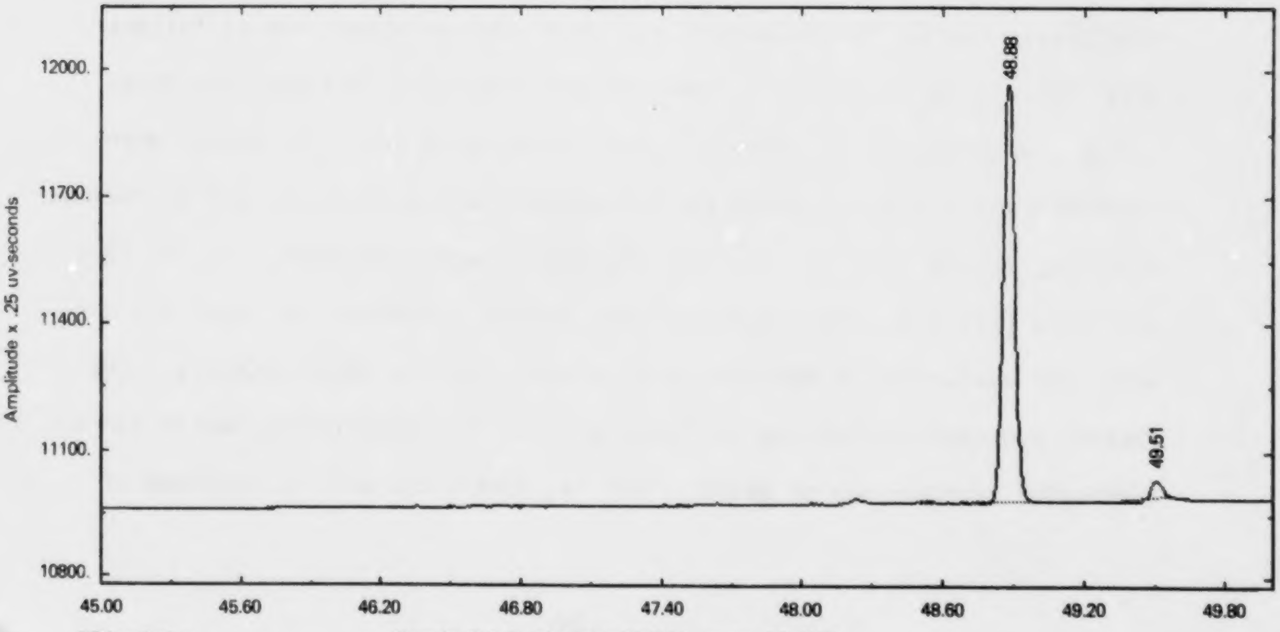
MIREX



Sample: Buff R S 100 Injected at 23:19:49 Jan. 26, 1983
Method: MIREX Raw: RMIR4 Proc: PMIR4

Mirex Standard
19.93 ug/ml in Isooctane

MIREX



Sample: Std 3 Injected at 20:47:04 on Jan. 26, 1983
Method: MIREX Raw: RMIR3 Proc. PMIR3

Table 3

Statistical Summary of Buffalo, New York 1981 Sediment Survey for PCBs, Pesticides, Metals, and Conventional Parameters

(All values are mg/kg dry weight)
(77 determinations from 65 sites)

Parameter	50% Median	Mode	Low	High	25%	75%
Aroclor 1248	.12	.07	0.03W	10.2	.03	.73
Aroclor 1254	.11	.02W	0.02W	9.0	0.02W	.61
Aroclor 1260	.04	.02W	0.02W	2.71	0.02W	.17
Total PCBs	.30	.07	0.005	20.5	0.08	1.57
o,p - DDE	.021	.022W	0.001W	.73	0.022W	.054
p,p - DDE	.015	.003W	0.001W	.218	0.002	.034
o,p - DDD	.009	.001W	0.001W	.53	0.001	.02
p,p - DDD	.014	.001W	0.001W	.353	0.002	.054
o,p - DDT	.008W	.002W	0.002W	.2	0.003W	.2W
p,p - DDT	.007	.02W	0.002W	2.55	0.02W	.017
Total DDT	.105	.007/ .033	0.005	2.318	0.033	.209
gamma-Chlordane	.006	.001W	0.001W	.301	0.102W	.014
alpha-Chlordane	.002W	.002W	0.002W	.002W	.002W	.002W
oxy-Chlordane	.006	.001W	0.001W	1.71	.006W	.016
Total Chlordane	.016	.002	.001	1.71	.007	.05
DCPA	.002W	.002W	0.001W	.24	0.002W	.002
Heptachlor Epoxide	.014	.001-.002- .002W	0.002W	1.0	0.003	.030
beta - BHC	.008	.01W	0.006W	1.23	0.01W	.038
gamma-BHC (Lindane)	.004	.002W	0.001W	3.25	0.002W	.006
Hexachlorobenzene	.002W	.002W	0.001W	72.095	0.002W	.018
Mirex	.004	.001W	0.001W	1.89	0.003W	.017
Methoxychlor	.03W	.002W	0.001W	.640	0.002W	.02
Endrin	.003W	.002W	0.001W	.267	0.002W	.003W
alpha-Endosulfan	.003W	.001W	0.001W	.07	0.001W	.02W
beta-Endosulfan	.003	.003W	0.001W	.20	0.003W	.012
Dieldrin	.001	.001W	0.001W	.26	0.001W	.002W
Zytron	.002	.012W-.04W	0.006W	6.89	0.003	.154
Di-n-Butyl Phthalate	.187	0.4W	0.01W	2.09	0.035	.55

Table 3 (Cont.)

Parameter	50% Median	Mode	Low	High	25%	75%
Cadmium	1.8	1.1- 1.8 - 4.2	0.22	25.0	0.60	4.2
Chromium	44.0	44.0	7.0	1000.	23.0	89.0
Copper	61.0	140.0	10.0	1600.	37.0	140.0
Lead	120.0	100.0	15.0	3300.	67.0	300.0
Mercury	0.50	0.30	0.10	24.0	0.30	1.10
Nickel	31.0	31.0 - 33.0	3.80	120.0	23.0	38.00
Zinc	270.00	120.0 - 230.0	54.0	3300.0	150.0	550.00
Barium	93.0	120	9.8	460	75	120
Manganese	490	420	8.5	5500	390.	670
Iron	26000	26000	4500	110000	19000	31000
Total Solids	5.30	3.1-51.1-8.3	0.70	25.40	3.6	8.30
Total Volatile Soilds	54.70	71.7	30.6	77.9	45.50	60.70
Total Kjeldahl Nitrogen	1500.0	1700.	170.	4700.	760.	2100.
Total Phosphorus	1300.0	1300.	260.	3900.	560.	1200
Chemical O_2 Demand	61000	120000.	3100.	310000	340000.	110000.
Phenols	0.90	0.60	0.4	350	0.60	1.60
Cyanide	2.50	2.10	1.20	84	1.70	3.90

W = Minimum Response Level of GC/EC

levels are lowered. Fewer sites will be included if levels are raised. Minor adjustments in levels will not have an effect.

A brief analysis of production method and compound uses has been undertaken on compounds found in the 1981 Buffalo Sediment Survey (Appendix G).

Production methods that account for most of the compounds found are involved in dye and solvent manufacturing and coal combustion.

Acknowledgments

We want to thank our colleagues within the Great Lakes National Program Office for support in planning, site selection, collection of sediments, compilation of data, data management, and interpretation of results. In particular Robert Bowden, David DeVault, Anthony Kizlauskas, Rosetta McPherson, Marvin Palmer, Michael Pandya, Meg Tung, and Stanley Witt deserve special mention for their efforts in this project.

The chemical analysis of the sediments were undertaken by Central Regional Laboratory, USEPA Region V, via contract to BIONETICS. Dr. Eric G. S. Rundberg, Chief, Organics Group, Bionetics, Mrs. Andrea Jirka, CRL, and Mrs. Marcia Kuehl, CRL, provided the information found in Appendix F.

We want to thank Clifford Risley, Jr. and Vacys Saulys for their reviews of the manuscript.

Dr. Gilman D. Veith of the Toxic Substances Research Branch of EPA's Environmental Research Laboratory provided valuable insight into unusual observations involving very high levels of chemicals not routinely observed in environmental samples.

Jean Sharp, Judy Greenberg and Gaynell Whatley are to be commended for their typing of the report and the extensive tables.

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Appendix A

Field Notes, Site Maps and Survey Site Tables

SEDIMENT SAMPLING

Buffalo Niagara River
May 6, 1981

Secondary
Buffalo No. 81-01

Cazenovia Creek, grey brown silt, fine sand, septic odor, some gravel no benthos visible, 10' from north bank, 1.5m deep, material washed out of coring device, collected ponar only.

Primary
Buffalo No. 81-02

Cazenovia Creek, 20' downstream from combined sewer overflow point, 10' from south bank, 1m deep, grey brown silt, fine sand, slight septic odor, some detritus, no benthos visible.

Secondary
Buffalo No. 81-03

Midstream-mouth of Cazenovia Creek just within Cazenovia Creek, grey brown silt, fine sand, septic odor, some gravel, no benthos, visible detritus.

Primary
Buffalo No. 81-04

10' from north bank of Buffalo River, 15' downstream from Worthington Corp. outfall, 1.5m deep, fine brown sand, oil spots, no benthos observed.

Primary
Buffalo No. 81-05

50' downstream from Baily Pump Station, 10' from north bank Buffalo River, 2m deep, brown-grey silt, some detritus and gravel, trace of oil, no benthos observed.

Secondary
Buffalo No. 81-06

Mobil Oil dock "786" marked on wall, 10' from wall, 4m deep, brown sandy silt, trace of oil, no benthos observed.

Primary
Buffalo No. 81-07

40' downstream from Mobil Oil API Seperator outfall, 10' from wall, 6m deep, sandy silt, detritus, trace of oil, no benthos visible.

Primary
Buffalo No. 81-08

Opposite Mobil Oil main discharge (6' wide box culvert), 5m deep, oily sandy silt, detritus, no benthos noted.

Secondary
Buffalo No. 81-09

10' from south bank, 1m deep, brown oily silt, oligochaetes found.

Primary
Buffalo No. 81-10

Downstream from Allied Chemical outfalls 001 and 002, 2m deep, brown-black silt with heavy oil, no benthos observed.

Primary
Buffalo No. 81-11

Downstream from Allied Chemical, 6m deep, brown black oily silt, no benthos observed.

Primary
Buffalo No. 81-12

Downstream from Buffalo Color outfall, oil boom around discharge, discharge colored black, 3m deep, black oily silt, no benthos observed.

Primary
Buffalo No. 81-13

15' from Republic Steel bulkhead, 4m deep, brown oily silt, no benthos observed.

No Sample
Buffalo No. 81-14

Downstream from Republic outfalls, bottom hard, no samples collected.

No Sample
Buffalo No. 81-15

Near flowing Republic Steel outfall, water black, bottom hard, no samples collected.

Primary
Buffalo No. 81-16

North bank, 10' off point, 4m deep, Rubble and garbage on bank, brown sandy silt, some oil, some detritus, no benthos observed.

Secondary
Buffalo No. 81-17

North bank, near outfall (Buffalo Color?), 1m deep, coarse sand, gravel, no benthos observed.

Secondary
Buffalo No. 81-18

10' from south bank, 3m deep, brown silt, leach observed.

Primary
Buffalo No. 81-19

North bank opposite combined sewer, 1m deep, black-brown silt, trace of oil, detritus, no benthos observed.

No Sample
Buffalo No. 81-20

Bottom hard, no sample after several tries.

Secondary
Buffalo No. 81-21

1m deep, gravel, brown sand, trace of oil, no benthos observed.

Primary
Buffalo No. 81-22

Less than 1m deep, grey black oily silt.

Secondary
Buffalo No. 81-23

4m deep, grey silt, gravel, trace of oil.

Primary
Buffalo No. 81-24

Downstream from Hamburg Street combined sewer, 1m deep, dark brown, oily silt and clay, blood worms observed.

Secondary
Buffalo No. 81-25

7m deep, grey silt, trace of oil, oligochaetes observed.

Primary
Buffalo No. 81-26

Mouth of slip with combined sewer, <1m deep, black-brown oily silt, petroleum odor, no benthos observed.

Primary
Buffalo No. 81-27

Opposite twin siphon discharge, brown silt oil, oligochaetes observed.

No Sample
Buffalo No. 81-30

Under expressway bridge on Scajaquada Creek. Creek impassable upstream due to log jam. Attempted to sample 6 times with no results due to large sticks and rocks on bottom. No sample

Primary
Buffalo No. 81-31

Mouth of Scajaquada Creek, sample primarly clay - silt with organic ooze overlay observed, oil was presented, no particular odor, some oligochaetes present, 1.5m deep.

Primary
Buffalo No. 81-32

.25 mile south of first lock in Black Rock Canal at mouth of small abandoned slip, sample primarly silt - clay with organic ooze, distinct anaerobic odor. 3m deep.

Secondary
Buffalo No. 81-33

West side of Black Rock Canal (Squaw Island) about midway between samples 81-31 and 81-34, silt - clay, detritus, some oil, 1.5m deep.

No Sample
Buffalo No. 81-34

Sample attempted in area with 4 outfalls in a 20 yard strech. No sample was taken despite repeated attempts on hard bottom which was partly covered from highway paving. Black Rock Canal.

Primary
Buffalo No. 81-35

Area of 6 outfalls near Rudy Schafer Grain and Hops Division, sample had foul odor and contained organic ooze, gravel, silt, and grain (apparently originated from Schafer's, 4m deep, Black Rock Canal.

No Sample
Buffalo No. 81-36

Sample attempted at clear (fluid) high volume outfall, 20 yards south of site Buffalo 81-35 in Black Rock Canal, outfall had sulphur odor and probably originated at Schager Grain and Hops Division, no sample taken due to hard bottom.

Primary
Buffalo No. 81-37

Primary sample in 2m of water in Black Rock Canal off the north end of Buffalo STP, sample primarly organic ooze and detritus - anaerobic odor.

No Sample
Buffalo No. 81-38

Sample attempted at north end of Buffalo STP in Black Rock Canal, rocky bottom prevented sampling.

No Sample
Buffalo No. 81-39

Sample attempted with no success on hard bottom at 10 yards north of First Bridge north of Peace Bridge.

Primary
Buffalo No. 81-40

10 yards south of Bridge (see Buffalo 81-39) on Squaw Island side of Black Rock Canal, sample consisted of black foul smelling organic ooze that burned when contacting skin abrasions, sample 2.5m deep.

Primary
Buffalo No. 81-41

Primary sample at outfall (Black Rock) 1/3 of the way between Peace Bridge and First Bridge to north of Peace Bridge, sample was silt - sand with oil evident, no odor, sample between 2 outfalls.

Secondary
Buffalo No. 81-42

Secondary sample just off south point of Squaw Island of Buffalo side of Black Neck, sample silt - clay.

Primary
Buffalo No. 81-43

Primary sample on Buffalo side of Black Rock at .25 mile north of Peace Bridge, sample consists of organic ooze with oil and slight oily odor.

Primary
Buffalo No. 81-44

8m of water in Black Rock Canal 50 yards south of power (high tension) lines, sample sandy silt with no odor or oil evident.

Primary
Buffalo No. 81-45

At sewer outfall in Black River, toilet paper and prophylaetics evident in water, site was off Front Park, sample was silt and sand - ooze with foul odor (fecal), 2m deep.

Primary
Buffalo No. 81-46

Buffalo Yacht Club Basin, sample consist of oily colloidal material with foul odor, 3m deep.

Secondary
Buffalo No. 81-47

Secondary sample off Water Pumping Plant, sample sand - small gravel, from 5m.

Primary
Buffalo No. 81-48

Clay with fecal odor just off Bird Island pier in Black Rock across from sample site 81-49.

Secondary
Buffalo No. 81-49

Black Rock just off water filtration plant on east side of canal, sample was silty sand in 4m of water.

Secondary
Buffalo No. 81-50

Erie Basin between 1st and 2nd piers, sample was clay and silt from 7m of water.

Primary
Buffalo No. 81-51

Mid-channel at mouth of Buffalo River, sample was silt - clay with no particular odor.

Primary
Buffalo No. 81-52

Primary sample from 7.5m of water in the Middle of Buffalo ship canal at 1st grain elevator, sample consists of silt and organic ooze grain and oligochaetes and a few midges.

Primary
Buffalo No. 81-53

Sample at point of penn. between Buffalo River and Buffalo ship Canal, sample in 3m, primarly clay, some oil and organic ooze.

Primary
Buffalo No. 81-54

7.5m deep, sample just south of Sky Way Bridge (R+5) in Buffalo Ship Canal, clay, oligochaetes present no special odor.

Primary
Buffalo No. 81-55

Mouth of Lakawana Ship Canal, sample in 11.5m of water, primarly silt and ooze with large amount of oil.

Secondary
Buffalo No. 81-56

7m deep, 50 yards west of west corner of Lackawana Canal, sample consists of grey & brown clay, oil, no benthos.

Primary
Buffalo No. 81-57

Sample at outfall in 5.5m of water at the right interior corner (facing in) of Union Canal, sample primarly clay and graphite with oil, sample had strong oily smell, no benthos was observed.

Primary
Buffalo No. 81-58

5.5m of water at the left interior corner of Union Canal, sample was oily, clay and organic ooze with metalic specks, no benthos.

Primary
Buffalo No. 81-59

7m of water just inside bridge on right side (facing) of Union Canal at discharge, sample contained no benthos, were composed of organic ooze and clay, oil present in sample and sample smells oily.

Primary
Buffalo No. 81-60

7m of water, center of the Mouth of the Union Canal, sample consists of clay, silt with oil present, no benthos observed, oily smell.

Primary
Buffalo No. 81-61

Mouth of Smokes Creek at 50 yards from shore line in 1.5m of water, sample consists of sand and red, brown, yellow clay with oil present, Industrial "foul" smelling.

Secondary
Buffalo No. 81-62

.2 miles out from the Mouth of Blaisdall Creek in 2.5m of water, sample primarily sand.

Secondary
Buffalo No. 81-63

About 50 yards from Mouth of Rush Creek, sample consists of sand only.

Secondary
Buffalo No. 81-64

4m of water, off point to north of Rush and Smokes Creek, sample was sand only.

Primary
Buffalo No. 81-65

4m of water just off 3rd dock in Small Boat Harbor, sample consists of clay - silt with some sand over layed with organic ooze, no particular odor.

Primary
Buffalo No. 81-66

Sample for outlet of landfill drainage into Small Boat Harbor, samples consists of sand - silt over layed by organic ooze, sample contain oil.

Primary
Buffalo No. 81-67

8m of water off northern tip of Squaw Island, sample consists of clay with some sand, gravel and shell.

No Sample
Buffalo No. 81-68

Sample attempted on west side of Squaw Island off old main outfall of Buffalo STP, no sample was possible on rocky clean swept bottom.

No Sample
Buffalo No. 81-69

Sample attempted on west side of Squaw Island at current main outfall (submerged) of Buffalo STP. This was located 100 feet from shore directly out from chlorination tanks. No sample was possible on rock bottom. A few rocks were obtained - these had many caddisfly larvae.

Primary
Buffalo No. 81-70

3.5m of water at Mouth of Rich Marina just north of Black Rock Canal, Sample consists of light brown and black clay and sand gravel.

Primary
Buffalo No. 81-71

2m of water in Corneilus Creek just north of JAFCO Marina (at creek mouth), sample consists of black sand and silt with some oil, oligochaetes present.

Primary
Buffalo No. 81-72

Sample in Niagara River of Vulcan Street exit of RT I190 near apparent sewer overflow, sample contained detritus organic ooze, and what appeared to be toilet paper.

Primary
Buffalo No. 81-73

2m of water just off Chevrolett Outfall 50 yards north of Dupont Marina (Niagara River), sample consists of black sand - silt with oil present.

No Sample
Buffalo No. 81-74

Sample attempted at south ash coaling pond of Niagara Mohawk, no sample possible on rock bottom.

Primary
Buffalo No. 81-75

Old landfill on east side of Niagara River, sample primarly sand with clay, 1m.

Primary
Buffalo No. 81-76

2m of water at Ashland Oil loading dock and discharge pipe, sample was taken at point 20 yards out from pipe and at 10 yards north of dock, sample consisted of sand and mud with some oil evident, no benthos observed.

No Sample
Buffalo No. 81-77

Sample attempted at Tonawanda STP Outfall (submerged), no sample possible on hard bottom.

Primary
Buffalo No. 81-78

1m of water at the Mouth of Two Mile Creek, sample consist of mud-clay with sand and oil, has fecal odor.

No Sample
Buffalo No. 81-79

Sample attempted at Spaulding Fiber discharge, no sample was obtained on hard bottom although effluent was black liquid.

Primary
Buffalo No. 81-80

At Tonawanda Sewer Bypass, sample consisted of grey mud-clay, no benthos observed, discharge location southeast of Tonawanda Island, 1.5m of water.

Primary
Buffalo No. 81-81

At storm sewer overflow in Little River in 1m of water, sample was sand-mud-clay with oil and "chemical" smell.

Primary
Buffalo No. 81-82

At Wheatfield Street storm sewer in Little River at 300 yard north of site 81, water depth 1m, sample was clay with some sand, strong phenolic odor.

Primary
Buffalo No. 81-83

At storm sewer overflow at North Tonawanda STP, water depth 2m, sample was clay-silt overlayed by organic ooze, no benthos observed.

Secondary
Buffalo No. 81-84

At Kapper Paper Co. outfall, area was fairly well scoured and several dredged were required and composited to collect suitable size sample of sand-clay, no odor or benthos.

No Sample
Buffalo No. 81-85

Sample attempted at storm sewer .5 miles north of Kapper Paper, no sample possible on rocky bottom.

Primary
Buffalo No. 81-86

1.5m of water about 10 yards off Hooker Chemical landfill, sample primarly sand with some clay, foul odor, Niagara River.

Primary
Buffalo No. 81-87

Sample at Hooker Chemical Co. outfall, sample consists of sand and gravel with some mud, no benthos evident, sample taken in 2m of water.

Secondary
Buffalo No. 81-88

Sample at possible landfill at the Williams Road extension, sample in 1.5m of water at 15 yards from shore, consists of sand and some clay, no odor or benthos.

Primary
Buffalo No. 81-89

Sample in 1.5m of water at Hooker landfill, sample was black - mud, silt with musty odor, no benthos.

Primary
Buffalo No. 81-90

Sample at Olin dump, sample consists of sand and clay (brown & black streaks), site at 20 yards off Little River, <1m.

Secondary
Buffalo No. 81-91

Sample in north end of Little River (Cayuga Island), brown & black clay, no oil or odor, no benthos.

Primary
Buffalo No. 81-92

Storm sewer overflow just north of site 81-91, sample is clay and detritus with oil evident.

No Sample
Buffalo No. 81-93

Sample attempted just north of Hooker S area and inshore of City of Niagara Falls water intake, no sample possible on rocky bottom.

Primary
Buffalo No. 81-94

At 20 yards north of site 81-93, sample mostly large gravel and some clay, no odor.

Primary
Buffalo No. 81-95

In-shore from site 81-94, sample was taken in 1' of water and 4' from shore, primarly sand and gravel.

SEDIMENT SAMPLING

Buffalo River
September 3, 1981

Primary
Buffalo No. 12

50' downstream Buffalo Color outfall, 10' offshore, depth 20', dropped 10' - approximately 6" of core very oily, black soft.

Primary
Buffalo No. 12

75' downstream Buffalo Color, 20' offshore, dropped 25' (full depth), 8-10" core soft material, grey black, very oily.

Primary
Buffalo No. 74A

50' from corner of inlet sewer pipe core, depth 1m - grass on botton, sediment dark grey sand, some oil odor.

Primary
Buffalo No. 74B

Tributary 10' wide, oil bottom, 10' upshore from Niagara River, very oily black sediment - water collected with core line, depth of water 6", water noticably hot through rubber gloves.

Primary
Buffalo No. 80A

Ellicott Creek - depth 16', 2" core, dark grey silt over red clay.

Primary
Buffalo No. 87A

Approximately 8", core - clay & sand, brown black, metal specks, much aquatic plants on bottom, 50' offshore, depth 9'.

Primary
Buffalo No. 89A

Dark brown hard sand, much aquatic plants, 18" depth.

No Sample
Buffalo No. 90A

No sample, botton hard.

Primary
Buffalo No. 91A

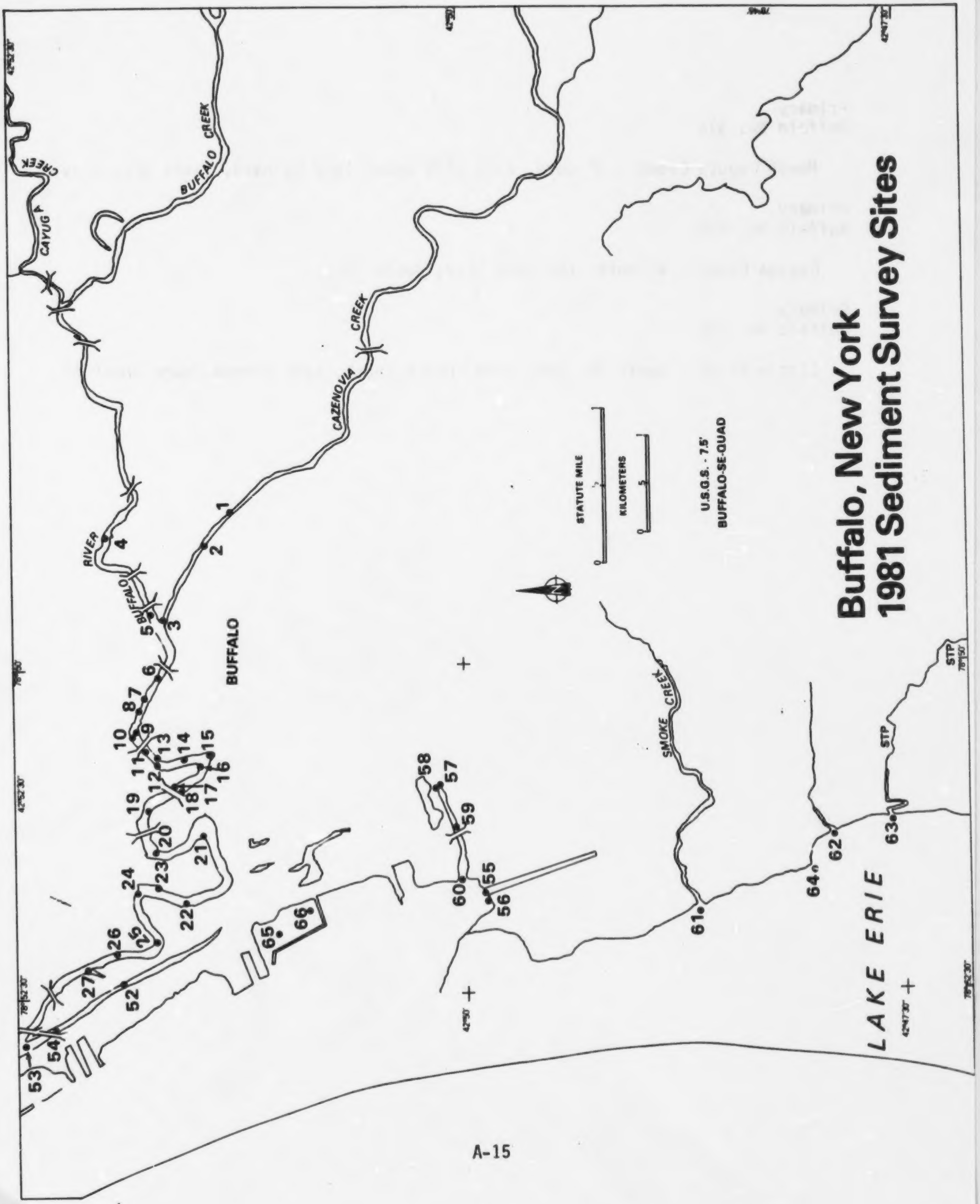
Mouth Cayuga Creek - 2" core, dark silt under laid by hard, light grey clay.

Primary
Buffalo No. 91B

Cayuga Creek - 6" core, red grey clay, depth 10'.

Primary
Buffalo No. 91C

Little River - depth 8', grey sand, black speck, some grease, core about 5".


CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
BUFFALO RIVER
BUFFALO
SMOKE CREEK
STP
STP
LAKE ERIE
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KILOMETERS
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U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
42°52'30"
42°50'
42°47'30"
78°45'
78°50'
78°52'30"
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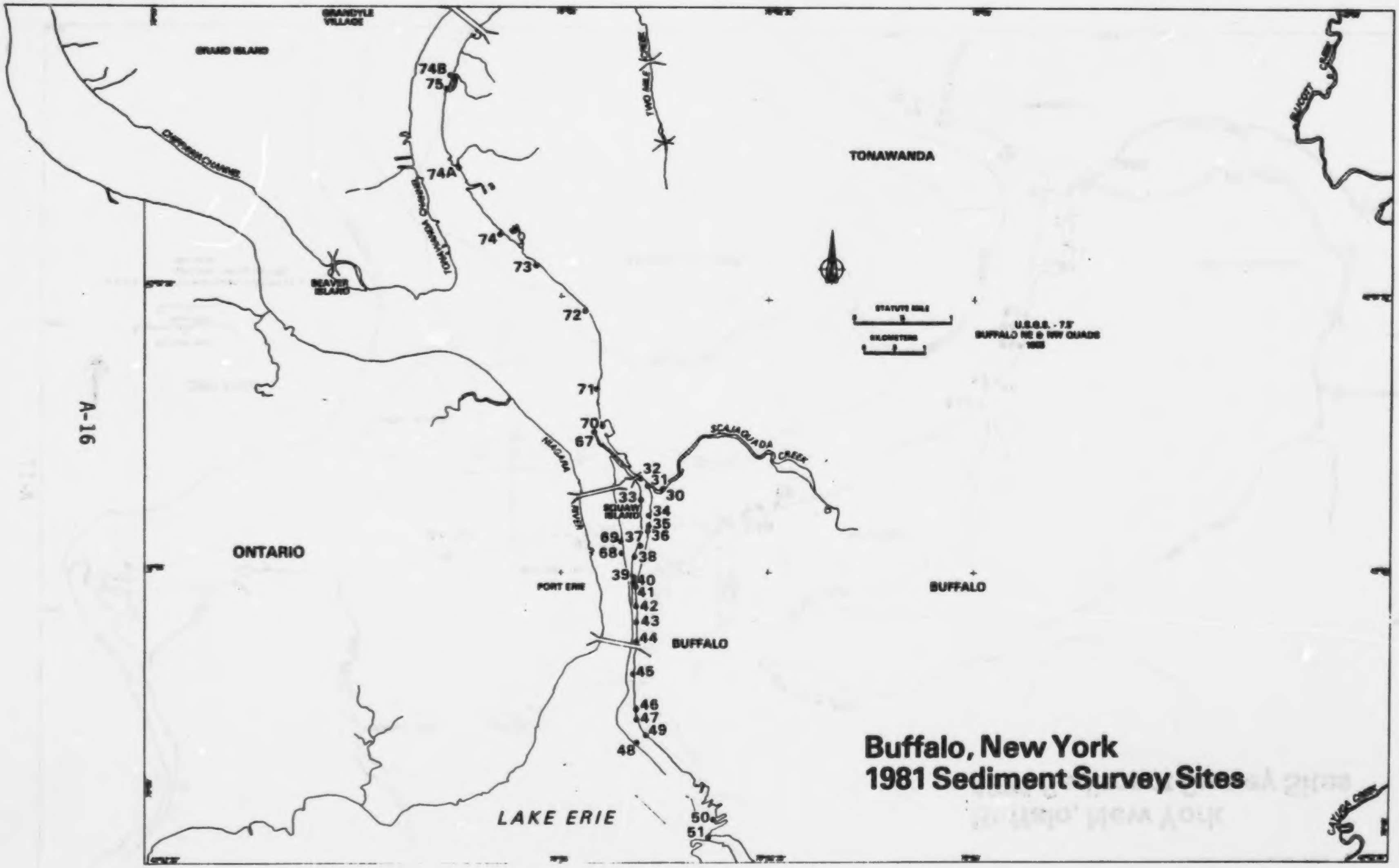
Buffalo, New York
1981 Sediment Survey Sites



GRAND ISLAND
GRANDYLE VILLAGE
CHIPPEWA CHANNEL
BEAVER ISLAND
TONAWANDA CHANNEL
TWO MILE CREEK
TONAWANDA
ELLICOTT CREEK
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO NE & NW QUADS
74B
75
74A
74
73
72
71
70
67
NIAGARA RIVER
SCAJAQUADA CREEK
32
31
30
33
SQUAW ISLAND
34
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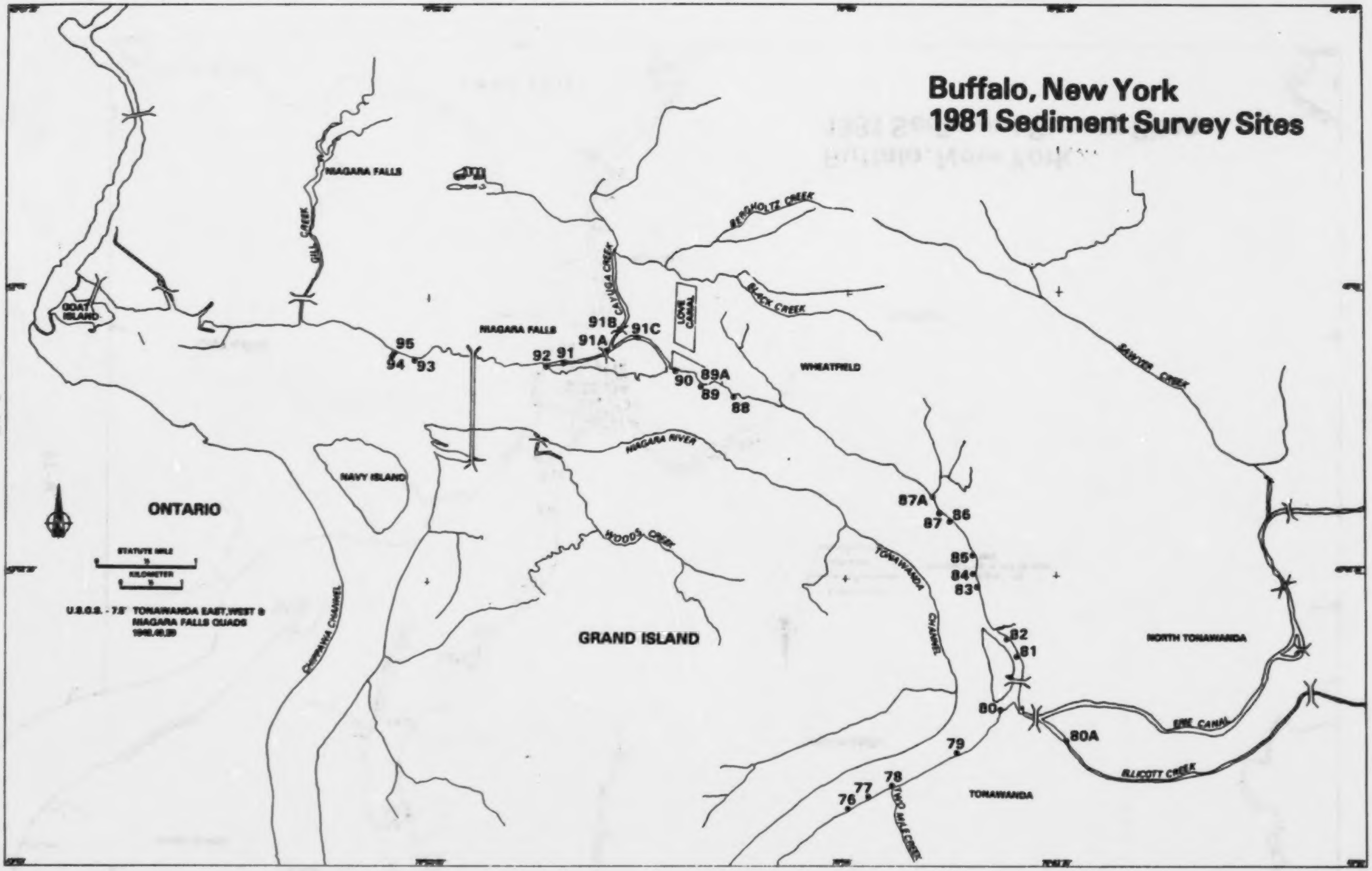
ONTARIO
FORT ERIE
BUFFALO
BUFFALO
LAKE ERIE
CAYUGA CREEK

Buffalo, New York
1981 Sediment Survey Sites

Buffalo, New York
1981 Sediment Survey Sites


NIAGARA FALLS
GILL CREEK
GOAT ISLAND
NIAGARA FALLS
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94
93
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91A
91B
91C
CAYUGA CREEK
LOVE CANAL
BERGHOLTZ CREEK
BLACK CREEK
WHEATFIELD
90
89A
89
88
SAWYER CREEK
NIAGARA RIVER
NAVY ISLAND
ONTARIO
WOODS CREEK
GRAND ISLAND
CHIPPAWA CHANNEL
TONAWANDA CHANNEL
87A
86
87
85
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80A
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TWO MILE CREEK
TONAWANDA
NORTH TONAWANDA
ERIE CANAL
ELLICOTT CREEK
STATUTE MILE
KILOMETER
U.S.G.S. - 7.5' TONAWANDA EAST, WEST &
NIAGARA FALLS QUADS

Appendix A
Table 1
Buffalo - New York
Survey Sites, May 6, 1981

Date	Depth (Meters)	CRL Log No.	STORET* Station Code	Latitude	Longitude	Sample Type**	Significance
810506	1.5	NS01S55	BUF 81-01	42'51°13"	78'48°48"	S	Cazenovia Creek
810506	1.0	NS01S56	BUF 81-02	42 51 23	78 49 03	P	Cazenovia Creek, Combined Sewer Outfall
810506	2.0	NS01S57	BUF 81-03	42 51 37	78 49 40	S	Cazenovia Creek, Mouth
810506	1.5	NS01S58	BUF 81-04	42 51 58	78 49 03	P	Worthington Corp. Buffalo River
810506	2.0	NS01S59	BUF 81-05	42 51 44	78 49 35	P	Baily Pumping Station Buffalo River
810506	4.0	- -	BUF 81-06	42 51 42	78 50 03	S	Mobile Oil, Buffalo River
810506	6.0	NS01S60	BUF 81-07	42 51 45	78 50 13	P	Mobile Oil, Buffalo River
810506	5.0	NS01S61	BUF 81-08	42 51 48	78 50 18	P	Mobile Oil, Buffalo River
810506	1.0	- -	BUF 81-09	42 51 48	78 50 29	S	Buffalo River
810506	2.0	NS01S62	BUF 81-10	42 51 51	75 50 32	P	Allied Chemical, Buffalo R.
810506	6.0	NS01S63	BUF 81-11	42 51 47	78 50 37	P	Allied Chemical, Buffalo R.
810506	3.0	NS01S64	BUF 81-12	42 51 43	78 50 42	P	Buffalo Color, Buffalo R.
810506	4.0	NS01S65	BUF 81-13	42 51 43	78 50 38	P	Republic Steel, Buffalo R.
810506	-	- -	BUF 81-14	42 51 32	78 50 41	NS	Republic Steel, Buffalo R.
810506	-	- -	BUF 81-15	42 51 22	78 50 42	NS	Republic Steel, Buffalo R.
810506	4.0	NS01S66	BUF 81-16	42 51 27	78 50 45	P	Buffalo River
810506	1.0	- -	BUF 81-17	42 51 37	78 50 54	S	Buffalo Color, Buffalo R.
810506	3.0	- -	BUF 81-18	42 51 34	78 50 55	S	Buffalo River, South Bank
810506	1.0	NS01S67	BUF 81-19	42 51 46	78 51 07	P	Combined Sewer Outfall, Buffalo River
810506	-	- -	BUF 81-20	42 51 41	78 51 41	NS	Buffalo River
810506	1.0	- -	BUF 81-21	42 51 28	78 51 17	S	Buffalo River
810506	1.0	NS01S68	BUF 81-22	42 51 34	78 51 50	P	Buffalo River
810506	4.0	- -	BUF 81-23	42 51 43	78 51 39	S	Buffalo River
810506	1.0	NS01S69	BUF 81-24	42 51 49	78 51 42	P	Combined Sewer Outfall, Buffalo River
810506	7.0	- -	BUF 81-25	42 51 44	78 52 02	S	Buffalo River
810506	1.0	NS01S70	BUF 81-26	42 51 58	78 52 07	P	Combined sewer, Buffalo R.
810506	2.0	NS01S71	BUF 81-27	42 52 07	78 52 15	P	Siphon Discharge, Buffalo R.
810506	-	- -	BUF 81-28	No field work attempted			
810506	-	- -	BUF 81-29	No field work attempted			
810506	-	- -	BUF 81-30	42 55 49	78 53 45	NS	Expressway Bridge on Scajaquada Creek
810506	1.5	NS01S72	BUF 81-31	42 55 44	78 53 58	P	Mouth of Scajaquada Creek
810506	3.0	NS01S73	BUF 81-32	42 55 51	78 54 06	P	Black Rock Canal
810506	1.5	NS01S74	BUF 81-33	42 55 38	78 54 06	S	Black Rock Canal
810506	-	- -	BUF 81-34	42 55 30	78 53 56	NS	Black Rock Canal
810506	4.0	NS01S75	BUF 81-35	42 55 22	78 53 58	P	Schafer Grain & Hops, Black Rock Canal

*Agency code for these stations is A=1115GLSB
**P = Primary S = Secondary NS = No Sample

Appendix A
Table 1 (cont.)
Buffalo - New York
Survey Sites, May 6, 1981

Date	Depth (Meters)	CRL Log No.	STORET* Station Code	Latitude	Longitude	Sample Type**	Significance
810506	-	- -	BUF 81-36	42'55°26"	78'54°02"	NS	
810506	2.0	NS01S76	BUF 81-37	42 55 12	78 54 08	P	Sedimentation Area, Black Rock Canal
810506	-	- -	BUF 81-38	42 55 09	78 54 09	NS	Buffalo STP, Black Rock Canal
810506	-	- -	BUF 81-39	42 54 56	78 54 01	NS	Buffalo STP, Black Rock Canal
810506	2.5	NS01S77	BUF 81-40	42 54 53	78 54 10	P	Black Rock Canal, West bank
810506	2.0	NS01S78	BUF 81-41	42 54 50	78 54 07	P	Outfall, Black Rock Canal
810506	2.0	- -	BUF 81-42	42 54 42	78 54 08	S	S.Squaw Isld. Black Rock Canal
810506	2.0	NS01S79	BUF 81-43	42 54 34	78 54 08	P	Black Rock Canal, East Side
810506	8.0	NS01S80	BUF 81-44	42 54 24	78 54 08	P	Black Rock Canal
810506	2.0	NS01S81	BUF 81-45	42 54 08	78 54 09	P	Black Rock Canal, Combined Sewer Outfall
810506	3.0	- -	BUF 81-46	42 53 49	78 54 08	P	Buffalo Yacht Basin
810506	5.0	- -	BUF 81-47	42 53 43	78 54 07	S	Buffalo Pumping Station
810506	2.0	NS01S82	BUF 81-48	42 53 32	78 54 04	P	Black Rock Canal
810506	4.0	- -	BUF 81-49	42 53 34	78 53 58	S	Black Rock Canal
810506	7.0	- -	BUF 81-50	42 52 50	78 53 12	S	Erien Yatch Basin
810506	2.0	NS01S83	BUF 81-51	42 52 41	78 53 15	P	Buffalo River, Mouth
810506	7.5	NS01S84	BUF 81-52	42 51 55	78 52 23	P	Buffalo Ship Canal
810506	3.0	NS01S85	BUF 81-53	42 52 27	78 52 50	P	Buffalo Ship Canal, Buffalo River
810506	7.5	NS01S86	BUF 81-54	42 52 18	78 52 43	P	Buffalo Ship Canal
810506	11.5	NS01S87	BUF 81-55	42 49 52	78 51 43	P	Takawana Ship Canal, Mouth
810506	7.0	NS01S88	BUF 81-56	42 49 51	78 51 48	S	Buffalo Harbor
810506	5.5	NS01S89	BUF 81-57	42 50 09	78 50 46	P	Union Canal, Outfall
810506	5.5	NS01S90	BUF 81-58	42 50 10	78 50 47	P	Union Canal, Outfall
810506	7.0	NS01S91	BUF 81-59	42 50 03	78 51 05	P	Union Ship Canal, Outfall
810506	7.0	NS01S92	BUF 81-60	42 50 00	78 51 36	P	Union Canal, Mouth
810506	1.5	NS01S93	BUF 81-61	42 48 39	78 51 51	P	Smokes Creek
810506	2.5	- -	BUF 81-62	42 47 56	78 51 20	S	Blaisdall Creek
810506	2.0	- -	BUF 81-63	42 47 36	78 51 12	S	Rush Creek
810506	4.0	- -	BUF 81-64	42 48 02	78 51 32	S	Rush and Smokes Creek
810506	4.0	NS01S94	BUF 81-65	42 51 00	78 52 02	P	Small Boat Harbor
810506	2.0	NS01S95	BUF 81-66	42 50 50	78 51 50	P	Landfill Drainage, Small Boat Harbor
810506	2.0	NS01S96	BUF 81-67	42 56 18	78 53 37	P	North Point Squaw Island
810506	-	- -	BUF 81-68	42 55 09	78 54 07	NS	W. Side of Squal Island - Old Main Outfall Buffalo Outfall STP
810506	-	- -	BUF 81-69	42 55 16	78 54 17	NS	W. Side of Squaw Island - Current Main Outfall Buffalo STP

*Agency code for these stations is A=1115GLSB
**P = Primary S = Secondary NS = No Sample

Appendix A
Table 1 (cont.)
Buffalo - New York
Survey Sites, May 7, 1981

Date	Depth (Meters)	CRL Log No.	STORET* Station Code	Latitude	Longitude	Sample Type**	Significance
810506	3.5	NS01S97	BUF 81-70	42'56°20"	78'54°32"	P	Rich Marina
810506	2.0	NS01S98	BUF 81-71	41 56 42	78 54 36	P	Cornelius Creek
810506	2.0	NS01S99	BUF 81-72	42 57 22	78 54 47	P	Niagara River, Combined Sewer
810506	2.0	NS01S00	BUF 81-73	42 57 45	78 55 22	P	Chevrolet Outfall
810506	-	- -	BUF 81-74	42 58 00	78 54 17	NS	S. Ash Cooling Pond - Niagara Mohawk
810507	1.0	NS02S01	BUF 81-75	42 59 17	78 56 29	P	Landfill
810507	2.0	NS02S02	BUF 81-76	43 00 28	78 54 57	P	Ashland Oil Discharge
810507	-	- -	BUF 81-77			NS	Tonawanda STP Outfall
810507	1.0	NS02S03	BUF 81-78	43 00 38	78 54 25	P	Two Mile Creek, Mouth
810507	-	- -	BUF 81-79			NS	Spaulding Fiber Discharge
810507	1.5	- -	BUF 81-80	43 01 20	78 53 04	P	Tonawanda Sewer Bypass
810507	1.0	NS02S04	BUF 81-81	43 01 45	78 52 51	P	Little River, Combined Sewer
810507	1.0	NS02S05	BUF 81-82	43 01 58	78 52 58	P	Wheeler St. Little River, Combined Sewer
810507	2.0	NS02S06	BUF 81-83	43 02 26	78 53 23	P	N. Tonawanda, Combined Sewer
810507	2.0	- -	BUF 81-84	43 02 33	78 53 25	S	Kopper Paper, Outfall
810507	-	- -	BUF 81-85			NS	Storm Sewer, 5 Miles North Kopper Paper
810507	1.5	NS02S07	BUF 81-86	43 03 00	78 53 44	P	Hooker Chemical, Landfill
810507	2.0	NS02S08	BUF 81-87	43 03 06	78 53 55	P	Hooker Chemical, Outfall
810507	1.5	- -	BUF 81-88	43 04 06	78 56 19	S	Williams Road, Landfill
810507	1.5	NS02S09	BUF 81-89	43 04 13	78 56 44	P	Hooker Chemical, Landfill
810507	1.0	NS02S10	BUF 81-90	43 04 18	78 57 02	P	Olin Landfill
810507	2.0	- -	BUF 81-91	43 09 24	78 58 18	S	Little River, N. End
810507	2.0	NS02S11	BUF 81-92	43 04 23	78 58 31	P	Little River, Combined Sewer
810507	-	- -	BUF 81-93			NS	N. of Hooker "S" Area, of Water Intake, City of Niagara Falls
810507	2.0	- -	BUF 81-94	43 04 29	79 00 27	P	Hooker Chemical, "S" Landfill
810507	2.0	NS02S12	BUF 81-95	43 04 30	79 00 27	P	Hooker Chemical, "S" Landfill

*Agency code for these stations is A=1115GLSB
**P = Primary S = Secondary NS = No Sample

Table 2
Buffalo - New York
Survey Sites, September 3, 1981

Date	Depth (Meters)	CRL Log No.	STORET* Station Code	Latitude	Longitude	Sample Type**	Significance
810903	3.0	NS03S66	BUF 81-12	42'51°43"	78 50 42	P	Buffalo Color Buffalo River
810903	7.6	NS03S67	BUF 81-12	42 51 43	78 50 42	P	Buffalo Color Buffalo River
810903	7.7	NS03S68	BUF 81-12	(Lower Half of Core Sample NS03S67)			
810903	1.0	NS03S69	BUF 81-74A	42 58 36	78 56 20	P	Tonawanda Channel
810903	1.0	NS03S70	BUF 81-74B	42 59 35	78 56 20	P	Tonawanda Channel
810903	8.0	NS03S76	BUF 81-80A	43 01 02	78 52 20	P	Ellicott Creek
810903	3.0	NS03S71	BUF 81-87A	43 03 15	78 54 00	P	Niagara River Channel
810903	1.0	NS03S72	BUF 81-89A	43 04 13	78 56 44	P	Hooker Chemical, Landfill
810903	-	- -	BUF 81-90A	43 04 18	78 57 48	NS	Curuga Is. Tonawanda Channel
810903	2.0	NS03S73	BUF 81-91A	43 04 32	78 57 49	P	Little River
810903	3.0	NS03S74	BUF 81-91B	43 04 48	78 57 38	P	Cayuga River
810903	2.0	NS03S75	BUF 81-91C	43 04 34	78 57 15	P	Little River

*Agency code for these stations is A=115GLSB
**P = Primary S = Secondary NS = No Sample

APPENDIX B

Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments

B-i

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
CHICAGO, ILLINOIS
APRIL 1977

GUIDELINES FOR THE POLLUTIONAL CLASSIFICATION OF GREAT LAKES HARBOR SEDIMENTS

Guidelines for the evaluation of Great Lakes harbor sediments, based on bulk sediment analysis, have been developed by Region V of the U.S. Environmental Protection Agency. These guidelines, developed under the pressure of the need to make immediate decisions regarding the disposal of dredged material, have not been adequately related to the impact of the sediments on the Lakes and are considered interim guidelines until more scientifically sound guidelines are developed.

The guidelines are based on the following facts and assumptions:

1. Sediments that have been severely altered by the activities of man are most likely to have adverse environmental impacts.
2. The variability of the sampling and analytical techniques is such that the assessment of any sample must be based on all factors and not on any single parameter with the exception of mercury and polychlorinated biphenyls (PCBs).
3. Due to the documented bioaccumulation of mercury and PCBs, rigid limitations are used which override all other considerations.

Sediments are classified as heavily polluted, moderately polluted, or nonpolluted by evaluating each parameter measured against the scales shown below. The overall classification of the sample is based on the most predominant classification of the individual parameters. Additional factors, such as elutriate test results, source of contamination, particle size distribution, benthic macroinvertebrate populations, color, and odor are also considered. These factors are interrelated in a complex manner and their interpretation is necessarily somewhat subjective.

Table 1

The following ranges used to classify sediments from Great Lakes harbors are based on compilations of data from over 100 different harbors since 1967.

	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED
Volatile Solids (%)	<5	5 - 8	>8
COD (mg/kg dry weight)	<40,000	40,000 - 80,000	>80,000
TKN (" " " ")	<1,000	1,000 - 2,000	>2,000
Oil & Grease (Hexane Solubles) (mg/kg dry weight)	<1,000	1,000 - 2,000	>2,000
Lead (mg/kg dry weight)	<40	40 - 60	>60
Zinc (" " " ")	<90	90 - 200	>200

The following supplementary ranges used to classify sediments from Great Lakes harbors have been developed to the point where they are usable but are still subject to modification by the addition of new data. These ranges are based on 260 samples from 34 harbors sampled during 1974 and 1975.

	NONPOLLUTED	MODERATELY POLLUTED (mg/kg dry weight)	HEAVILY POLLUTED
Ammonia	<75	75-200	>200
Cyanide	<0.10	0.10-0.25	>0.25
Phosphorus	<420	420-650	>650
Iron	<17,000	17,000-25,000	>25,000
Nickel	<20	20-50	>50
Manganese	<300	300-500	>500
Arsenic	<3	3-8	>8
Cadmium	*	*	>6
Chromium	<25	25-75	>75
Barium	<20	20-60	>60
Copper	<25	25-50	>50

* Lower limits not established

The guidelines stated below for mercury and PCBs are based upon the best available information and are subject to revision as new information becomes available.

Methylation of mercury at levels ≥1 mg/kg has been documented (1, 2). Methyl mercury is directly available for bioaccumulation in the food chain.

Elevated PCB levels in large fish have been found in all of the Great Lakes. the accumulation pathways are not well understood. However, bioaccumulation of PCBs at levels ≥10 mg/kg in fathead minnows has been documented (3).

Because of the known bioaccumulation of these toxic compounds, a rigid limitation is used. If the guidelines values are exceeded, the sediments are classified as polluted and unacceptable for open lake disposal no matter what the other data indicate.

	POLLUTED
Mercury	≥1 mg/kg dry weight
Total PCBs	≥10 mg/kg dry weight

The pollutional classification of sediments with total PCB concentrations between 1.0 mg/kg and 10.0 mg/kg dry weight will be determined on a case-by-case basis.

APPENDIX C

Analytical Results

Tables

1. Concentrations of Volatile Organics in Sediments

2 Concentrations of Semi-Volatile Organics in Sediments

3. Concentrations of PCBs and Pesticides in Sediments

4. Concentrations of Metals in Sediments

5. Concentrations of Conventional Pollutants in Sediments

Table 1

Concentrations of Volatiles in Sediments of the Buffalo and Niagara Rivers, New York, 1981

(All concentrations are in mg/kg dry weight)

Parameter	Sampling Site												
	01	02	03	04	05	06	07	08	10	11	12	12	D12
Acetophenone	0.35*												
Benzene	0.03	0.014	0.014	0.03						0.107	0.06	1.84	1.06
Bromodichloromethane													*
Butanone													
1-Butyl-2-propylcyclopentane													
Carbon disulfide													
Chlorobenzene										0.084	6.8	>30.97	>27.1
Chloroform	0.14	0.03	0.04		0.05		0.05	0.04				0.60	0.444
(Deuterochloroform)	0.45*	0.09*	0.15*		0.18*		0.18*	0.15*	0.017* 0.09*				
Chlorotoluene											4.5		
Cyclohexane											1.7	*	*
Dibromochloromethane	0.05		0.014		0.01		0.02	0.01					
Dibromoethane								0.001*					
Dibromomethane													
Dichlorobenzene										0.4*	1.7 10.0*	>34.1*	>29.6*
1,1-Dichloroethane					0.02			0.01					
1,2-Dichloroethane													*
1,2-Dichloroethylene												0.037	0.019
1,2-Dichloropropane													*
Diethylbenzene													
Diethyl ether	0.06*	0.06*	0.03*				0.01*			0.087	0.6	*	*

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site													
	12	12	13	16	19	22	24	26	D26	27	31	32	33	35
Acetophenone														
Benzene	0.061													
Bromodichloromethane														
Butanone														0.05*
1-Butyl-2-propylcyclopentane														
Carbon disulfide														
Chlorobenzene	2.05	0.016								0.007				0.002
Chloroform		0.033	0.02			0.03	0.032							
(Deuterochloroform)		0.02*	0.08*	0.03*	0.02*	0.1*	0.13*							
Chlorotoluene														
Cyclohexane														
Dibromochloromethane						0.004								
Dibromoethane	*													
Dibromomethane														
Dichlorobenzene	2.24*	0.074*								0.01* 0.13*				0.23*
1,1-Dichloroethane	0.008													
1,2-Dichloroethane														0.03
1,2-Dichloroethylene														
1,2-Dichloropropane														
Diethylbenzene								1.16*						
Diethyl ether	0.11*		0.12*	0.29*	0.02*	0.01*		0.24*	0.01*	0.01*				

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	37	40	41	43	44	45	48	51	52	53	54	55	D55
Acetophenone													
Benzene												0.004	0.003
Bromodichloromethane													
Butanone													
1-Butyl-2-propylcyclopentane			0.1*										
Carbon disulfide													
Chlorobenzene						0.01			*	0.01	*		
Chloroform													
(Deuterochloroform)							0.02*						
Chlorotoluene													
Cyclohexane													
Dibromochloromethane													
Dibromoethane												0.005*	
Dibromomethane													
Dichlorobenzene													
1,1-Dichloroethane													
1,2-Dichloroethane													
1,2-Dichloroethylene													
1,2-Dichloropropane													
Diethylbenzene													
Diethyl ether					0.07*		0.16*						

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	56	57	58	59	60	61	65	66	67	70	71	D71	72
Acetophenone													
Benzene		0.004											
Bromodichloromethane													
Butanone													
1-Butyl-2-propylcyclopentane													
Carbon disulfide													
Chlorobenzene	*												
Chloroform													
(Deuterochloroform)													
Chlorotoluene													
Cyclohexane													
Dibromochloromethane													
Dibromoethane													
Dibromomethane													
Dichlorobenzene													
1,1-Dichloroethane													
1,2-Dichloroethane													
1,2-Dichloroethylene													
1,2-Dichloropropane													
Diethylbenzene													
Diethyl ether		0.05*											

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	73	74A	74B	75	76	78	80A	81	82	83	86	87	87A
Acetophenone													
Benzene							0.005		0.01				
Bromodichloromethane													
Butanone													
1-Butyl-2-propylcyclopentane													
Carbon disulfide													
Chlorobenzene			0.003					*	1.00	0.011	0.004		
Chloroform		0.012	1.19										0.038
(Deuterochloroform)		0.024*											0.11*
Chlorotoluene									1.0 7.1	0.34	0.31	0.09	
Cyclohexane													
Dibromochloromethane			*										0.011
Dibromoethane													
Dibromomethane				0.005*			0.005*	0.003*		0.001*	0.002*	0.04*	
Dichlorobenzene									2.8*	0.04*	0.03*		
1,1-Dichloroethane									1.0*	0.07*	0.05*	0.36*	
1,2-Dichloroethane													0.014
1,2-Dichloroethylene													
1,2-Dichloropropane													0.011
Diethylbenzene													
Diethyl ether		0.032*					0.049*						0.16*

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site								
	89	89A	90	91A	91B	91C	92	D92	95
Acetophenone									
Benzene									0.01
Bromodichloromethane									
Butanone									
1-Butyl-2-propylcyclopentane									
Carbon disulfide						0.013			
Chlorobenzene	0.002	0.014				0.005	0.016	0.016	<0.002
Chloroform		0.041		0.112	0.172				
(Deuterochloroform)									
Chlorotoluene	0.01*						0.07*	0.09*	
Cyclohexane									
Dibromochloromethane									
Dibromoethane									
Dibromomethane	0.003*		0.003*				0.004*		
Dichlorobenzene							0.06* 0.08*	0.06* 0.12*	0.04*
1,1-Dichloroethane									
1,2-Dichloroethane									
1,2-Dichloroethylene									
1,2-Dichloropropane									
Diethylbenzene									
Diethyl ether		0.043*				0.145*			

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	01	02	03	04	05	06	07	08	10	11	12	12	D12
Dimethylcyclohexane													
Dimethylcyclopentane													
Dimethyl disulfide													
Dimethyl ether													
Dimethyltetrahydrofuran													0.06
Ethylbenzene										0.046	0.03*	0.89	0.50
Ethylcyclopentane												0.56*	0.38*
1-Ethyl-2-methylcyclohexane												*	0.015
Ethylpropylbenzene													
Ethyltoluene													
Hexane				0.05*									
Hydrocarbons								0.02*	1.989*		5.1*		
(Hydrocarbons-Alcohols)										7.5*			
(Hydrocarbons-Aromatics)													
Methylcyclodecane													
Methylcyclohexane												1.58*	1.13*
Methylcyclopentane												*	*
Methylene chloride	6.9	2.24	2.87	0.82	0.01	0.02	*			0.035	0.06	2.63	1.76
2-Methylhexane												0.39*	0.31*
3-Methylhexane												0.21*	0.14*

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site													
	12	12	13	16	19	22	24	26	D26	27	31	32	33	35
Dimethylcyclohexane	0.14													
Dimethylcyclopentane	0.03													
Dimethyl disulfide														0.34*
Dimethyl ether														
Dimethyltetrahydrofuran														
Ethylbenzene	0.011													
Ethylcyclopentane														
1-Ethyl-2-methylcyclohexane														
Ethylpropylbenzene											0.11*			
Ethyltoluene									1.0* 1.42*	1.6* 2.8*	0.53*			
Hexane														
Hydrocarbons	1.16*		1.3*	0.9*	0.29*	0.4*	0.4*	2.5*	5.2*	0.62*	3.3*	4.8*	5.2*	0.85*
(Hydrocarbons-Alcohols)														
(Hydrocarbons-Aromatics)														
Methylcyclodecane	0.33*													
Methylcyclohexane	0.11*													
Methylcyclopentane														
Methylene chloride	1.0	0.031	0.02	0.12	0.01	0.023								0.22
2-Methylhexane														
3-Methylhexane														

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	37	40	41	43	44	45	48	51	52	53	54	55	D55
Dimethylcyclohexane													
Dimethylcyclopentane													
Dimethyl disulfide													
Dimethyl ether		0.01*											
Dimethyltetrahydrofuran													
Ethylbenzene										0.003			
Ethylcyclopentane													
1-Ethyl-2-methylcyclohexane													
Ethylpropylbenzene													
Ethyltoluene													
Hexane													
Hydrocarbons	1.0*	1.1*	1.11*	1.1*	0.9*		0.36*	0.25*	0.26*	0.7*	0.8*	0.5*	1.1*
(Hydrocarbons-Alcohols)													
(Hydrocarbons-Aromatics)													
Methylcyclodecane													
Methylcyclohexane										0.02*			
Methylcyclopentane													
Methylene chloride	0.02	0.01	0.013	0.04		0.07	0.334				0.004		
2-Methylhexane													
3-Methylhexane													

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	56	57	58	59	60	61	65	66	67	70	71	D71	72
Dimethylcyclohexane													
Dimethylcyclopentane													
Dimethyl disulfide						0.01*							
Dimethyl ether													
Dimethyltetrahydrofuran													
Ethylbenzene													
Ethylcyclopentane													
1-Ethyl-2-methylcyclohexane													
Ethylpropylbenzene													
Ethyltoluene													
Hexane													
Hydrocarbons	2.6*	0.09*	0.57*		0.65*	0.48*	0.32*	0.41*	0.65*	0.59*	0.5*	0.3*	0.81*
(Hydrocarbons-Alcohols)													
(Hydrocarbons-Aromatics)													
Methylcyclodecane													
Methylcyclohexane													
Methylcyclopentane													
Methylene chloride	0.003	0.346	0.02		0.002			0.016	0.004	0.016	0.003	0.03	0.022
2-Methylhexane													
3-Methylhexane													

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	73	74A	74B	75	76	78	80A	81	82	83	86	87	87A
Dimethylcyclohexane													
Dimethylcyclopentane													
Dimethyl disulfide													
Dimethyl ether													
Dimethyltetrahydrofuran													
Ethylbenzene			0.002						0.124				
Ethylcyclopentane													
1-Ethyl-2-methylcyclohexane													
Ethylpropylbenzene													
Ethyltoluene									0.18*				
Hexane													
Hydrocarbons	0.19*			0.27*	0.13*	1.8*		0.16*	1.6*	0.08*	0.20*	0.024*	2.34*
(Hydrocarbons-Alcohols)													
(Hydrocarbons-Aromatics)													
Methylcyclodecane													
Methylcyclohexane													
Methylcyclopentane													
Methylene chloride		1.37	0.146	0.19	0.007		0.007	0.004		0.056	1.06	1.37	
2-Methylhexane													
3-Methylhexane													

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site								
	89	89A	90	91A	91B	91C	92	D92	95
Dimethylcyclohexane									
Dimethylcyclopentane									
Dimethyl disulfide									
Dimethyl ether									
Dimethyltetrahydrofuran									
Ethylbenzene									
Ethylcyclopentane									
1-Ethyl-2-methylcyclohexane									
Ethylpropylbenzene									
Ethyltoluene									
Hexane									
Hydrocarbons	0.008*		0.01*				0.12*		
(Hydrocarbons-Alcohols)			0.01*						
(Hydrocarbons-Aromatics)	0.01*								
Methylcyclodecane									
Methylcyclohexane									
Methylcyclopentane									
Methylene chloride	0.191	0.195	0.091	0.071	0.119	0.482	0.16	0.15	
2-Methylhexane									
3-Methylhexane									

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site											
	01	02	03	04	05	07	08	10	11	12	12	D12
1-Methyl-2-propylcyclopentane												
2-(2-propenyl)toluene									0.34*			
Propylbenzene												
Propyltoluene												
(Substituded cyclohexanes)												
1,1,2,2-Tetrachloroethane												
Tetrachloroethylene	*										1.94	0.787
Thiobis(methane)												
Toluene	0.12	0.06	0.07	2.3					0.064	0.04	11.39	3.14
Tribromomethane	0.07				0.004	0.01						
Trichlorobenzene												
Trichloroethane							0.002					
1,1,1-Trichloroethane					0.01		0.01					
1,1,2-Trichloroethane												*
Trichloroethylene											0.038	0.027
Trimethylbenzene												
Trimethylcyclohexane												
1,1,3-Trimethylcyclohexane												
m-Xylene									0.086	0.06	1.92	0.673
o- and p-Xylenes		0.05	0.04	0.08					0.086	0.1	1.41	0.512

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	12	12	13	16	19	22	24	26	D26	27	31	32	33	35
1-Methyl-2-propylcyclopentane											0.7*			
2-(2-propenyl)toluene														
Propylbenzene								0.84*	2.5*					
Propyltoluene									0.7*					
(Substituted cyclohexanes)	0.63* 0.65*													
1,1,2,2-Tetrachloroethane	*													
Tetrachloroethylene	0.004													0.015
Thiobis(methane)														0.4*
Toluene	0.045			0.21						0.006				1.2
Tribromomethane	0.004					0.006								*
Trichlorobenzene														
Trichloroethane														
1,1,1-Trichloroethane														
1,1,2-Trichloroethane														
Trichloroethylene														
Trimethylbenzene										1.15*				
Trimethylcyclohexane	0.12*													
1,1,3-Trimethylcyclohexane											0.5*			
m-Xylene	0.02							0.06	0.04					
o- and p-Xylenes	0.02							0.03	0.02					

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	37	40	41	43	44	45	48	51	52	53	54	55	D55
1-Methyl-2-propylcyclopentane										0.1*			
2-(2-propenyl)toluene													
Propylbenzene													
Propyltoluene													
(Substituted cyclohexanes)													
1,1,2,2-Tetrachloroethane													
Tetrachloroethylene													
Thiobis(methane)													
Toluene				7.9		4.9	0.06	0.004				0.004	
Tribromomethane													
Trichlorobenzene													
Trichloroethane													
1,1,1-Trichloroethane													
1,1,2-Trichloroethane													
Trichloroethylene													
Trimethylbenzene													
Trimethylcyclohexane													
1,1,3-Trimethylcyclohexane										0.1*			
m-Xylene						0.02				*			
o- and p-Xylenes						0.03 0.7				0.01			

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	56	57	58	59	60	61	65	66	67	70	71	D71	72
1-Methyl-2-propylcyclopentane													
2-(2-propenyl)toluene													
Propylbenzene													
Propyltoluene													
(Substituted cyclohexanes)													
1,1,2,2-Tetrachloroethane													
Tetrachloroethylene													
Thiobis(methane)						0.03*							
Toluene	*	0.008											5.6
Tribromomethane													
Trichlorobenzene													
Trichloroethane													
1,1,1-Trichloroethane													
1,1,2-Trichloroethane													
Trichloroethylene													
Trimethylbenzene													
Trimethylcyclohexane													
1,1,3-Trimethylcyclohexane													
m-Xylene													
o- and p-Xylenes		0.003											

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site												
	73	74A	74B	75	76	78	80A	81	82	83	86	87	87A
1-Methyl-2-propylcyclopentane													
2-(2-propenyl)toluene													
Propylbenzene													
Propyltoluene													
(Substituted cyclohexanes)			0.017*										
1,1,2,2-Tetrachloroethane			0.005										
Tetrachloroethylene			0.004								0.005	0.012	0.004
Thiobis(methane)													
Toluene	0.18		0.008					0.004	0.04				0.009
Tribromomethane			0.003									0.005	0.012
Trichlorobenzene											0.54*	0.002* 0.008* 0.10 * 0.004* 0.01 *	
Trichlorobenzene													
Trichloroethane													
1,1,1-Trichloroethane													0.008
1,1,2-Trichloroethane			*										
Trichloroethylene													
Trimethylbenzene													
Trimethylcyclohexane													
1,1,3-Trimethylcyclohexane													
m-Xylene			0.003			*			0.342	0.002			
o- and p-Xylenes			0.004						0.411	0.003			

*Tentative identification and approximate quantitation

Table 1, cont.

Parameter	Sampling Site								
	89	89A	90	91A	91B	91C	92	D92	95
1-Methyl-2-propylcyclopentane									
2-(2-propenyl)toluene									
Propylbenzene									
Propyltoluene									
(Substituted cyclohexanes)									
1,1,2,2-Tetrachloroethane		0.002			0.002				
Tetrachloroethylene		0.003		0.003	0.002				
Thiobis(methane)									
Toluene	0.002		0.001			0.007	0.004	0.008	0.007
Tribromomethane		0.002			0.002				
Tichlorobenzene									
Trichlorobenzene									
Trichloroethane									
1,1,1-Trichloroethane									
1,1,2-Trichloroethane									
Trichloroethylene									
Trimethylbenzene									
Trimethylcyclohexane									
1,1,3-Trimethylcyclohexane									
m-Xylene									
o-and p-Xylenes									

*Tentative identification and approximate quantitation

Table 2

Concentrations of Semi-Volatiles in Sediments of the Buffalo and Niagara Rivers, New York, 1981
(All values are mg/kg dry weight)

Parameter	Sampling Site										
	01	02	03	04	05	07	08	10	11	12	12
Acenaphthene	0.01	0.02					0.04	0.01	0.78	80.	3.5
Acenaphthylene											
Aldrin											
Benzeneacetaldehyde											430.*
alpha-BHC			*								
beta-BHC			*								
Benzo(b)fluoranthene			1.3	0.8	0.8						
Benzo(g,h,i)fluoranthene											
Benzo(a)fluorene 11H											
Benzo(g,h,i)perylene											
Benzo(a)pyrene	0.8										
1,1'-Biphenyl									17.*		
Butylbenzylphthalate	0.01	0.3	0.3				0.2				
t-butylnaphthalene											
Butylphenol											
p-t-butylphenol											
2-Chloroaniline											2.2*
1-Chloroanthraquinone											130.*
Chlorobenzilate											
2-Chloronaphthalene											4.0
1-Chloro-2-nitrobenzene											
1-Chloro-3-nitrobenzene											320.*
Cholestan-3-alpha-ol											
Chrysene/Benz(a)anthracene	2.2	4.0		10.3		3.0	2.1				
p-Cresol		3.0*									
4H-Cyclopenta(d,e,f) phenanthrene											
o-Cymene											
Diacetone Alcohol									40.*		
Dibenzofuran											
Di-N-butylphthalate	0.03	0.5	1.1	0.9	0.6		0.6				
1,2-Dichlorobenzene										6.6	171.9
1,3-Dichlorobenzene											
1,4-Dichlorobenzene											
1,3-Dichlorobenzene+1,4, Dichlorobenzene										10.	7.8
Dichlorobiphenyl (1)											
Dichlorobiphenyl (2)											
p,p-DDE									*		
o,p-DDT											
2,4-Dichloronitrobenzene											8.6*

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site										
	D12	12	12	16	19	22	24	26	D26	27	D27
Acenaphthene	5.6		0.3		0.1				0.3		
Acenaphthylene											
Aldrin											
Benzeneacetaldehyde	420.*	7.1*	0.3*								
alpha-BHC			*								
beta-BHC											
Benzo(b)fluoranthene								96.9	70.1		
Benzo(g,h,i)fluoranthene											
Benzo(a)fluorene 11H						0.4*					
Benzo(g,h,i)perylene											
Benzo(a)pyrene								72.5	32.4		
1,1'-Biphenyl											
Butylbenzylphthalate											
t-butylnaphthalene											
Butylphenol											
p-t-butylphenol											
2-Chloroaniline	2.5*										
1-Chloroanthraquinone	120.*	16.*	14.								
Chlorobenzilate		*	*								
2-Chloronaphthalene	7.3										
1-Chloro-2-nitrobenzene											
1-Chloro-3-nitrobenzene	350.*	0.7*									
Cholestan-3-alpha-ol											
Chrysene/Benz(a)anthracene		15.	16.		5.2	6.7		60.2	48.6	17.9	
p-Cresol											
4H-Cyclopenta(d,e,f) phenanthrene											
o-Cymene											
Diacetone Alcohol											
Dibenzofuran											
Di-N-butylphthalate				9.1		0.6	0.2			0.7	
1,2-Dichlorobenzene	242.8	3.3	6.2		0.4						
1,3-Dichlorobenzene		2.0	0.8		0.2	2.6	0.1				
1,4-Dichlorobenzene		3.0	1.2		1.6	0.9	0.2				
1,3-Dichlorobenzene+1,4, Dichlorobenzene	10.										
Dichlorobiphenyl (1)											
Dichlorobiphenyl (2)											
p,p-DDE											
o,p-DDT											
2,4-Dichloronitrobenzene	8.7*										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site										
	31	32	33	35	37	40	41	43	44	45	48
Acenaphthene	2.7	0.2		0.3	0.1		0.2	0.2			
Acenaphthylene		1.9									
Aldrin		*									
Benzeneacetaldehyde											
alpha-BHC							*				
beta-BHC							*				
Benzo(b)fluoranthene										20.	
Benzo(g,h,i)fluoranthene											
Benzo(a)fluorene 11H											
Benzo(g,h,i)perylene											
Benzo(a)pyrene			16.2	25.0	27.9			34.7		5.	
1,1'-Biphenyl											
Butylbenzylphthalate											
t-butylnaphthalene											
Butylphenol											
p-t-butylphenol											
2-Chloroaniline											
1-Chloroanthraquinone											
Chlorobenzilate											
2-Chloronaphthalene											
1-Chloro-2-nitrobenzene											
1-Chloro-3-nitrobenzene											
Cholestan-3-alpha-ol						14.*					
Chrysene/Benz(a)anthracene	31.2	20.6	10.2	22.9	18.4	11.9	29.1	21.2	6.7	47.	
p-Cresol											
4H-Cyclopenta(d,e,f) phenanthrene											
o-Cymene											
Diacetone Alcohol											
Dibenzofuran											
Di-N-butylphthalate			0.8	8.6	0.7	0.6	1.7		0.9	2.8	4.1
1,2-Dichlorobenzene		1.7									
1,3-Dichlorobenzene		1.2									
1,4-Dichlorobenzene		1.7									
1,3-Dichlorobenzene+1,4, Dichlorobenzene											
Dichlorobiphenyl (1)											
Dichlorobiphenyl (2)											
p,p-DDE								*			
o,p-DDT				*							
2,4-Dichloronitrobenzene											

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	51	52	53	54	55	D55	56	D56	57	58
Acenaphthene					42.2	49.0	0.5	0.5		
Acenaphthylene					2.1	2.5		0.27		
Aldrin										
Benzeneacetaldehyde										
alpha-BHC										
beta-BHC										
Benzo(b)fluoranthene					59.0	19.4				63.
Benzo(g,h,i)fluoranthene										
Benzo(a)fluorene 11H										
Benzo(g,h,i)perylene					13.2					
Benzo(a)pyrene				9.1	106.5	13.				
1,1'-Biphenyl				0.6		66.0	69.0	57.1		
Butylbenzylphthalate										
t-butylnaphthalene										
Butylphenol										
p-t-butylphenol										
2-Chloroaniline										
1-Chloroanthraquinone										
Chlorobenzilate										
2-Chloronaphthalene										
1-Chloro-2-nitrobenzene										
1-Chloro-3-nitrobenzene										
Cholestan-3-alpha-ol										
Chrysene/Benz(a)anthracene		4.9			10.8	3.5	10.4	66.4	24.2	16.7
p-Cresol										
4H-Cyclopenta(d,e,f) phenanthrene					4.2*	4.7*				
o-Cymene										
Diacetone Alcohol										
Dibenzofuran					1.7*	2.2*				
Di-N-butylphthalate	1.6	1.8	1.8		2.3	0.7				
1,2-Dichlorobenzene		*								
1,3-Dichlorobenzene										
1,4-Dichlorobenzene		*								
1,3-Dichlorobenzene+1,4, Dichlorobenzene										
Dichlorobiphenyl (1)										
Dichlorobiphenyl (2)										
p,p-DDE										
o,p-DDT										
2,4-Dichloronitrobenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	59	60	61	65	66	67	70	71	D71	72
Acenaphthene		0.2		0.07	0.03	0.2	0.12	0.2	0.7	1.6
Acenaphthylene		0.3								
Aldrin										
Benzeneacetaldehyde										
alpha-BHC				*						
beta-BHC				*						
Benzo(b)fluoranthene										
Benzo(g,h,i)fluoranthene										
Benzo(a)fluorene 11H										
Benzo(g,h,i)perylene										
Benzo(a)pyrene		14.								
1,1'-Biphenyl										
Butylbenzylphthalate										
t-butylnaphthalene										
Butylphenol										
p-t-butylphenol										
2-Chloroaniline										
1-Chloroanthraquinone										
Chlorobenzilate										
2-Chloronaphthalene										
1-Chloro-2-nitrobenzene										
1-Chloro-3-nitrobenzene										
Cholestan-3-alpha-ol										
Chrysene/Benz(a)anthracene	11.7	38.3	2.4	16.7	1.1	7.9	4.5	6.5	19.3	0.7
p-Cresol										
4H-Cyclopenta(d,e,f) phenanthrene										8.7*
o-Cymene										
Diacetone Alcohol										
Dibenzofuran										
Di-N-butylphthalate							0.9	0.3	0.3	9.6*
1,2-Dichlorobenzene										
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
1,3-Dichlorobenzene+1,4, Dichlorobenzene										
Dichlorobiphenyl (1)										
Dichlorobiphenyl (2)										
p,p-DDE		*								
o,p-DDT										
2,4-Dichloronitrobenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site											
	73	74A	74B	75	76	78	80A	81	82	83	86	87
Acenaphthene	0.6	1.0										
Acenaphthylene												
Aldrin												
Benzeneacetaldehyde							3.4*					
alpha-BHC												
beta-BHC												
Benzo(b)fluoranthene												
Benzo(g,h,i)fluoranthene												
Benzo(a)fluorene 11H												
Benzo(g,h,i)perylene												
Benzo(a)pyrene												
1,1'-Biphenyl									0.9*			
Butylbenzylphthalate												
t-butylnaphthalene												
Butylphenol									1.7*			
p-t-butylphenol	6.1*											
2-Chloroaniline												
1-Chloroanthraquinone												
Chlorobenzilate		*										
2-Chloronaphthalene												
1-Chloro-2-nitrobenzene												
1-Chloro-3-nitrobenzene												
Cholestan-3-alpha-ol												
Chrysene/Benz(a)anthracene	59.5	9.7	1.4	7.1								
p-Cresol												
4H-Cyclopenta(d,e,f) phenanthrene												
o-Cymene												
Diacetone Alcohol												
Dibenzofuran									1.7*			
Di-N-butylphthalate				0.6								
1,2-Dichlorobenzene		0.2					0.3					
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
1,3-Dichlorobenzene+1,4, Dichlorobenzene												
Dichlorobiphenyl (1)												
Dichlorobiphenyl (2)												
p,p-DDE												
o,p-DDT												
2,4-Dichloronitrobenzene												

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	87A	89	89A	90	91A	91B	91C	92	D92	95
Acenaphthene										
Acenaphthylene										
Aldrin										
Benzeneacetaldehyde										
alpha-BHC										
beta-BHC										
Benzo(b)fluoranthene										
Benzo(g,h,i)fluoranthene										
Benzo(a)fluorene										
Benzo(g,h,i)perylene										
Benzo(a)pyrene										
1,1'-Biphenyl										
Butylbenzylphthalate										
t-butylnaphthalene										
Butylphenol										
p-t-butylphenol										
2-Chloroaniline										
1-Chloroanthraquinone										
Chlorobenzilate										
2-Chloronaphthalene										
1-Chloro-2-nitrobenzene										
1-Chloro-3-nitrobenzene										
Cholestan-3-alpha-ol										
Chrysene/Benz(a)anthracene	27.							55.4		
p-Cresol										
4H-Cyclopenta(d,e,f) phenanthrene										
o-Cymene										
Diacetone Alcohol					1500.*	7700.*				
Dibenzofuran										
Di-N-butylphthalate								0.3	7.3	1.1
1,2-Dichlorobenzene	1.7				1.3			5.2		
1,3-Dichlorobenzene	0.9							17.5		
1,4-Dichlorobenzene	1.4		0.8					21.4		
1,3-Dichlorobenzene+1,4, Dichlorobenzene										
Dichlorobiphenyl (1)										
Dichlorobiphenyl (2)										
p,p-DDE										
o,p-DDT										
2,4-Dichloronitrobenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	01	02	03	04	05	07	08	10	11	12
Dieldrin			*		*		*	*	*	
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate	0.03	0.03	0.1							
Dimethoxyanthracene			3.5*							
3,4-Dimethyl-1,1'-biphenyl				4.3*						
4,5-Dimethyl-2-Cyclohexen-1-one									65.*	
Dimethyldibenzofuran			1.4*					7.2*	14.*	
2,6-Dimethyl-2,5-heptadien-4-one										
Dimethylnaphthalene										
Dimethylnaphthalene (2)										
1,4-Dimethylnaphthalene										
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-dimethylnaphthothiophene					34.*					
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene				28.*	90.*		13.*	100.*		
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine										
Endosulfan I					*				*	
Endosulfan II					*		*	*	*	
Endrin			*							
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate	1.1	9.0		0.9			0.8		1.04	
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene	0.9	0.8	1.0	1.8	2.8		0.7	1.8	4.22	35.6
Fluorene	0.04	0.04							0.10	
Heptachlor										*
Hexachlorobenzene										*
Hexachlorobutadiene										
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	D12	12	12	13	16	19	22	24	26	D26
Dieldrin	*									
Diethylbenzene									0.3*	0.2*
Diethylbenzene (2)									0.3*	0.2*
Diethylphthalate							0.3	0.1		0.6
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen-1-one							0.3*	0.4*	0.3*	7.04*
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien-4-one										
Dimethylnaphthalene		0.9*				0.2*		0.2*	0.9*	0.7*
Dimethylnaphthalene (2)								0.2*	1.0*	0.8*
1,4-Dimethylnaphthalene							0.3*			
1,7-Dimethylnaphthalene							0.3*			
2,7-Dimethylnaphthalene						0.2*				
4,9-dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene		1.8*							1.1*	>.04*
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine										
Endosulfan I				*			*			
Endosulfan II		*	*							
Endrin										
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene									0.2*	0.2*
Bis(2-ethylhexyl)phthalate					3.7		1.1		26.1	53.4
Ethyltoluene									0.4*	0.4*
4-Ethyltoluene									0.6*	0.6*
Fluoranthene	7.4	7.4	7.	2.3		3.0	4.0	*	22.0	18.3
Fluorene	5.1	0.6	0.5							
Heptachlor				*						
Hexachlorobenzene	113.5									
Hexachlorobutadiene										
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	27	D27	31	32	33	35	37	40	41	43
Dieldrin	*		*	*		*	*		*	
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate										
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen-1-one	9.2*	2.2*	1.2*	0.3*	0.3*	0.7*			0.5*	3.1*
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien-4-one										
Dimethylnaphthalene			6.2*	0.8*						9.5*
Dimethylnaphthalene (3)			3.7*	1.8*						
1,4-Dimethylnaphthalene										
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-Dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene			7.8*	2.4*						
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine										
Endosulfan I										
Endosulfan II				*		*	*		*	
Endrin										
Epoxy (2 ,3 ,5) Cholestan-3 -ol								17.*		
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate	1.9	1.9		34.7	8.9	6.8	22.9	13.1	28.8	17.5
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene	2.4	2.4	33.4	17.3	5.0	13.9	9.8	6.3	15.1	13.1
Fluorene			1.1							0.4
Heptachlor				*					*	
Hexachlorobenzene										
Hexachlorobutadiene										
Hexadecanoic acid									18.5*	

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	44	45	48	51	52	53	54	55	D55	56
Dieldrin							*	*	*	
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate				0.3	1.7	1.2		0.8	0.6	
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen -1-one										
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien -4-one										
Dimethylnaphthalene										
Dimethylnaphthalene (2)										
1,4-Dimethylnaphthalene										
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-Dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene								4.4*	4.3*	
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine				*						
Endosulfan I										
Endosulfan II							*	*		
Endrin										
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate		9.3		1.6		1.8				
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene	2.3	16.9	0.7	1.7	22.1	1.4	4.6	63.9	57.6	13.1
Fluorene								2.2	2.0	1.0
Heptachlor										
Hexachlorobenzene										
Hexachlorobutadiene										
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	D56	57	58	59	60	61	65	66	67	70
Dieldrin						*	*		*	
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate										
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen -1-one									1.1*	0.3*
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien -4-one										
Dimethylnaphthalene			6.*		2.8*					
Dimethylnaphthalene (2)										
1,4-Dimethylnaphthalene										
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-Dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene										
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol			4.0		*					
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine										
Endosulfan I										
Endosulfan II			*			*	*			
Endrin										
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate								0.45		1.7
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene	13.9	5.5	17.6	10.7	13.5	2.0	5.6	2.4	7.5	4.5
Fluorene	1.7				0.7					
Heptachlor			*			*				
Hexachlorobenzene										
Hexachlorobutadiene										
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	71	D71	72	73	74A	74B	75	76	78	80A
Dieldrin			*	*						
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate										
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen -1-one								1.2*	0.2*	
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien -4-one										6.1*
Dimethylnaphthalene										
Dimethylnaphthalene (2)			1.6*		0.8*				2.3*	
1,4-Dimethylnaphthalene									1.8*	
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-Dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene	0.2*	0.1*								
3,4-Dimethyl-2-pentene				0.7*						
Dimethylphenanthrene			7.4*						1.5*	
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine										
Endosulfan I										
Endosulfan II			*	*						
Endrin										
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate		2.8	5.8			1.9	0.2			
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene	7.2	11.8	50. 1	8.5	3.4	14.1	3.7			1.1
Fluorene		3.0	2.6		0.6					
Heptachlor										
Hexachlorobenzene										
Hexachlorobutadiene										
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	81	82	83	86	87	87A	89	89A	90	91A
Dieldrin						*				
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate										
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen -1-one	31.*			0.2*			1.*		1.5*	
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien -4-one					0.8*					
Dimethylnaphthalene										
Dimethylnaphthalene (2)										
1,4-Dimethylnaphthalene										
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-Dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene						1.9*				
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane						2.9*				
Diphenylether		2.2*								
1,2-Diphenylhydrazine										
Endosulfan I										
Endosulfan II										
Endrin						*				
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol										
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate						4.2		0.6		
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene						7.5				
Fluorene						0.6				
Heptachlor						*				
Hexachlorobenzene										
Hexachlorobutadiene										
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	91B	91C	92	D92	95					
Dieldrin			*							
Diethylbenzene										
Diethylbenzene (2)										
Diethylphthalate				15.1						
Dimethoxyanthracene										
3,4-Dimethyl-1,1'-biphenyl										
4,5-Dimethyl-2-Cyclohexen -1-one										
Dimethyldibenzofuran										
2,6-Dimethyl-2,5-heptadien -4-one										
Dimethylnaphthalene										
Dimethylnaphthalene (2)										
1,4-Dimethylnaphthalene										
1,7-Dimethylnaphthalene										
2,7-Dimethylnaphthalene										
4,9-Dimethylnaphthothiophene										
2,3-Dimethyl-2-pentene										
3,4-Dimethyl-2-pentene										
Dimethylphenanthrene										
2,7-Dimethylphenanthrene										
2,4-Dimethylphenol										
1,3-Dioxane										
Diphenylether										
1,2-Diphenylhydrazine										
Endosulfan I										
Endosulfan II			*							
Endrin										
Epoxy (2 ,3 ,5) Cholestan-3 -ol										
4-Ethyl-1,3-benzenediol	0.5*									
3-Ethyl-o-xylene										
Bis(2-ethylhexyl)phthalate	0.5		19.7	7.0						
Ethyltoluene										
4-Ethyltoluene										
Fluoranthene			14.1	9.6						
Fluorene										
Heptachlor										
Hexachlorobenzene					1.0					
Hexachlorobutadiene					0.47					
Hexadecanoic acid										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site								
	01	02	03	04	05	07	08	10	11
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene									
3-Hexen-2-one									
Hydrocarbons	370*	1000.*	570.*	500.*	440.*	0.3*	120.*		360.*
Indeno(1,2,3-cd)pyrene									
Isodrin									
Lindane									
Methylanthracene					57.*				
Methylbenzo(g,h,i) fluoranthene									
Methylchrysene				20.*					
4-Methyldibenzofuran									19.*
(1-Methyldodecyl)benzene									
Methylfluoranthene					49.*				
Methylfluoranthene (2)									
1-Methyl-2-isopropyl-naphthalene									
1-Methylnaphthalene									
Methylnaphthalene									2.6*
Methylnaphthalene (2)									
2-Methyl-2-octen-4-one									
Methylphenanthrene			9.1*	19.*				52.*	67.*
Methylphenanthrene (2)									
Methylphenanthrene (3)									
Bis(2-methylphenyl)diazine									
Methylpyrene				21.*	52.*				
(1-Methyltridecyl)benzene									
Mirex									
Naphthalene	0.01	0.02							
N-Nitrosodiphenylamine									
2-Nitrotoluene									
4-Nitrotoluene+4-Chloraniline									
Nonylphenol									
Pentachlorobenzene									
Pentachlorobiphenyl (1)									
Pentachlorobiphenyl (2)									*
Pentachlorobiphenyl (3)							*		
Pentachlorotoluene									
Pentamethylnaphthalene								38.*	
t-Pentylbenzene									

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	12	12	D12	12	12	13	16	19	22	24
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene										
3-Hexen-2-one										
Hydrocarbons	270*	60.*	58.*	82.*	14.*	24.*		22.*	32.*	29.*
Indeno(1,2,3-cd)pyrene										
Isodrin				*						
Lindane	*									
Methylanthracene										
Methylbenzo(g,h,i) fluoranthene										
Methylchrysene										
4-Methyldibenzofuran										
(1-Methyldodecyl)benzene		3.2*	3.3*							
Methylfluoranthene										
Methylfluoranthene (2)										
1-Methyl-2-isopropyl-naphthalene								0.4*		
1-Methylnaphthalene									0.4*	0.3*
Methylnaphthalene				0.4*				0.2*		
Methylnaphthalene (2)										
2-Methyl-2-octen-4-one										
Methylphenanthrene										
Methylphenanthrene (2)										
Methylphenanthrene (3)										
Bis(2-methylphenyl)diazine		3.*	4.*							
Methylpyrene										
(1-Methyltridecyl)benzene		2.5*	2.8*							
Mirex										
Naphthalene	0.6	177.	239.1	3.2	2.2			0.4	0.4	0.1
N-Nitrosodiphenylamine		13.9	21.3	2.8	4.4	*				
2-Nitrotoluene		280.*	290.*							
4-Nitrotoluene+4-Chloraniline		100.*	100.*							
Nonylphenol										
Pentachlorobenzene		540.*	600.*	0.3*	0.2*					
Pentachlorobiphenyl (1)										
Pentachlorobiphenyl (2)										
Pentachlorobiphenyl (3)										
Pentachlorotoluene		1.5*	2.*							
Pentamethylnaphthalene										
t-Pentylbenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	26	D26	27	D27	31	32	33	35	37	40
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene										
3-Hexen-2-one										
Hydrocarbons	43.*	29.*	55.*	30.*	80.*	140.*	2.9*	3.1*	0.8*	14.*
Indeno(1,2,3-cd)pyrene										
Isodrin			*							
Lindane					*	*				
Methylanthracene										
Methylbenzo(g,h,i) fluoranthene										
Methylchrysene										
4-Methyldibenzofuran										
(1-Methyldodecyl)benzene										
Methylfluoranthene					3.1*					
Methylfluoranthene (2)					6.3*					
1-Methyl-2-isopropyl-naphthalene										
1-Methylnaphthalene										
Methylnaphthalene	0.6* 0.2*	0.4* 0.3*			1.7*	0.4*				
Methylnaphthalene (2)					1.5*	0.3*				
2-Methyl-2-octen-4-one										
Methylphenanthrene	0.6*	1.1*			10.*	3.7*				
Methylphenanthrene (2)	0.8*	>.04*			11.*					
Methylphenanthrene (3)	1.0*	>.04*								
Bis(2-methylphenyl)diazine										
Methylpyrene					3.6*					
(1-Methyltridecyl)benzene										
Mirex									*	
Naphthalene	1.3	1.1	0.6		4.0	0.7	0.2			0.3
N-Nitrosodiphenylamine										
2-Nitrotoluene										
4-Nitrotoluene+4-Chloraniline										
Nonylphenol	2.0*	3.9*								
Pentachlorobenzene										
Pentachlorobiphenyl (1)					0.2	1.5				
Pentachlorobiphenyl (2)					4.4	6.5				
Pentachlorobiphenyl (3)					3.0	3.5				
Pentachlorotoluene										
Pentamethylnaphthalene										
t-Pentylbenzene	0.1*	0.2*								

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	41	43	44	45	48	51	52	53	54	55
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene										
3-Hexen-2-one										
Hydrocarbons	20.1	110.*	43.*	180.*	29.*	25.*		29.*	13.*	
Indeno(1,2,3-cd)pyrene										10.*
Isodrin				*				*		
Lindane	*									
Methylanthracene										
Methylbenzo(g,h,i) fluoranthene										6.*
Methylchrysene										
4-Methyldibenzofuran										
(1-Methyldodecyl)benzene										
Methylfluoranthene										
Methylfluoranthene (2)										
1-Methyl-2-isopropyl-naphthalene										
1-Methylnaphthalene										
Methylnaphthalene										
Methylnaphthalene (2)										
2-Methyl-2-octen-4-one										
Methylphenanthrene				2.8*						6.8*
Methylphenanthrene (2)										
Methylphenanthrene (3)										
Bis(2-methylphenyl)diazine										
Methylpyrene										14.*
(1-Methyltridecyl)benzene										
Mirex										*
Naphthalene	0.4	0.4								18.1
N-Nitrosodiphenylamine				*		*	*	0.2	*	
2-Nitrotoluene										
4-Nitrotoluene+4-Chloraniline										
Nonylphenol										
Pentachlorobenzene										
Pentachlorobiphenyl (1)										
Pentachlorobiphenyl (2)										
Pentachlorobiphenyl (3)										
Pentachlorotoluene										
Pentamethylnaphthalene				2.3*						
t-Pentylbenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	D55	56	D56	57	58	59	60	61	65	66
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene										
3-Hexen-2-one										
Hydrocarbons		20.*	3.4*	21.*	120.*	4.2*		190.*	1.*	5.*
Indeno(1,2,3-cd)pyrene	9.4*									
Isodrin	*									
Lindane					*	*	*	*		
Methylanthracene										
Methylbenzo(g,h,i) fluoranthene	5.7*									
Methylchrysene										
4-Methyldibenzofuran										
(1-Methyldodecyl)benzene										
Methylfluoranthene		1.4*	0.5*	7.8*	3.0*		1.1*			
Methylfluoranthene (2)										
1-Methyl-2-isopropyl-naphthalene										
1-Methylnaphthalene										
Methylnaphthalene		<0.04*	0.1*		1.7*		0.7*			
Methylnaphthalene (2)							0.7*			
2-Methyl-2-octen-4-one										
Methylphenanthrene	6.3*									
Methylphenanthrene (2)										
Methylphenanthrene (3)										
Bis(2-methylphenyl)diazine										
Methylpyrene	13*	<0.04*	4.6*				2.0*			
(1-Methyltridecyl)benzene										
Mirex	*									
Naphthalene	23.0	3.9	4.3		0.7	0.4	1.1	0.07	0.24	0.23
N-Nitrosodiphenylamine										
2-Nitrotoluene										
4-Nitrotoluene+4-Chloraniline										
Nonylphenol										
Pentachlorobenzene										
Pentachlorobiphenyl (1)										
Pentachlorobiphenyl (2)										
Pentachlorobiphenyl (3)										
Pentachlorotoluene										
Pentamethylnaphthalene										
t-Pentylbenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	67	70	71	D71	72	73	74A	74B	75	76
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene										
3-Hexen-2-one										
Hydrocarbons	310.*	27.*	0.3*	4.3*	83.*	260.*	29.*	37.*	5.3*	
Indeno(1,2,3-cd)pyrene										
Isodrin	*				*					
Lindane										
Methylanthracene										
Methylbenzo(g,h,i) fluoranthene										
Methylchrysene										
4-Methyldibenzofuran										
(1-Methyldodecyl)benzene										
Methylfluoranthene					3.5*			0.8*		
Methylfluoranthene (2)										
1-Methyl-2-isopropyl-naphthalene										
1-Methylnaphthalene										
Methylnaphthalene					10.*			0.3*	0.1*	
Methylnaphthalene (2)					0.6*					
2-Methyl-2-octen-4-one										
Methylphenanthrene		4.1*						2.2*		
Methylphenanthrene (2)										
Methylphenanthrene (3)										
Bis(2-methylphenyl)diazine										
Methylpyrene										
(1-Methyltridecyl)benzene										
Mirex										
Naphthalene	0.1	0.3			0.8	0.3	1.2	3.1	0.8	
N-Nitrosodiphenylamine										
2-Nitrotoluene										
4-Nitrotoluene+4-Chloraniline										
Nonylphenol										
Pentachlorobenzene										
Pentachlorobiphenyl (1)										
Pentachlorobiphenyl (2)										
Pentachlorobiphenyl (3)					*	0.9				
Pentachlorotoluene										
Pentamethylnaphthalene										
t-Pentylbenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	78	80A	81	82	83	86	87	87A	89	89A
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene										
3-Hexen-2-one								7.2*		
Hydrocarbons								75.*		
Indeno(1,2,3-cd)pyrene										
Isodrin								*		
Lindane										
Methylanthracene										
Methylbenzo(g,h,i) fluoranthene										
Methylchrysene										
4-Methyldibenzofuran										
(1-Methyldodecyl)benzene										
Methylfluoranthene								2.*		
Methylfluoranthene ②										
1-Methyl-2-isopropyl-naphthalene										
1-Methylnaphthalene										
Methylnaphthalene								0.6*		
Methylnaphthalene ②										
2-Methyl-2-octen-4-one										
Methylphenanthrene										
Methylphenanthrene ②										
Methylphenanthrene ③										
Bis(2-methylphenyl)diazine										
Methylpyrene										
(1-Methyltridecyl)benzene										
Mirex										
Naphthalene		1.3						3.1		0.8
N-Nitrosodiphenylamine										
2-Nitrotoluene										
4-Nitrotoluene+4-Chloraniline										
Nonylphenol										
Pentachlorobenzene		0.3*								
Pentachlorobiphenyl ①										
Pentachlorobiphenyl ②										
Pentachlorobiphenyl ③										
Pentachlorotoluene										
Pentamethylnaphthalene										
t-Pentylbenzene										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site								
	90	91A	91B	91C	92	D92	95		
2,2,4,4,7,7-Hexamethyl-octahydro-1H-indene							0.3*		
3-Hexen-2-one									
Hydrocarbons					49.*	45.*	27.*		
Indeno(1,2,3-cd)pyrene									
Isodrin									
Lindane					*				
Methylanthracene									
Methylbenzo(g,h,i)fluoranthene									
Methylchrysene									
4-Methyldibenzofuran									
(1-Methyldodecyl)benzene									
Methylfluoranthene									
Methylfluoranthene (2)									
1-Methyl-2-isopropyl-naphthalene									
1-Methylnaphthalene									
Methylnaphthalene									
Methylnaphthalene (2)									
2-Methyl-2-octen-4-one							0.1		
Methylphenanthrene									
Methylphenanthrene (2)									
Methylphenanthrene (3)									
Bis(2-methylphenyl)diazine									
Methylpyrene									
(1-Methyltridecyl)benzene									
Mirex									
Naphthalene		0.7		0.4					
N-Nitrosodiphenylamine									
2-Nitrotoluene									
4-Nitrotoluene+4-Chloraniline									
Nonylphenol									
Pentachlorobenzene		0.04*		0.04*			0.2		
Pentachlorobiphenyl (1)									
Pentachlorobiphenyl (2)									
Pentachlorobiphenyl (3)									
Pentachlorotoluene									
Pentamethylnaphthalene									
t-Pentylbenzene									

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	01	02	03	04	05	07	08	10	11	12
1-Pentylheptylbenzene										
Perylene			0.25*							
Phenanthrene/Anthracene	0.4	0.5	0.6	0.8	1.2		0.4	1.5	3.56	15.4
Phenol										
Phenylacetic Acids	8.8*									
Pyrene	0.8	0.6	1.0	2.8	4.0		1.0	1.3	3.05	26.7
Tetrachlorobenzene										
Tetrachlorobenzene (2)										
Tetrachlorobiphenyl (1)			*				*	*	*	*
Tetrachlorobiphenyl (2)			*					*	*	*
Tetrachlorobiphenyl (3)			*		*		*	*	*	*
Tetrachlorobiphenyl (4)			*				*	*	*	*
Tetrachlorobiphenyl (5)										*
Tetradecanoic acid										
Tetradifon										
Tetramethylbenzene										
Tetramethylbenzene (2)										
(Tetramethylbutyl)phenol										
4(1,1,3,3-tetramethylbutyl) phenol										
Tetramethylnaphthalene					32.*				57.*	60.*
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2-Butylthiophene										
1,2,4-Trichlorobenzene										
Trichlorobiphenyl (1)										
Trichlorobiphenyl (2)										
Trichlorobiphenyl (3)										
2,3,3-Trimethylbutene										
Trimethyl-2-Cyclohexen-1-one										
4,4,5-Trimethyl-2-hexene										
Trimethylnaphthalene			2.8*		15.*			29.*	29.*	
Trimethylnaphthalene (2)										
Trimethylphenanthrene			9.2*	29.*	79.*		10.*	110.*		
Trimethylphosphate										
(1,2,3-Trimethyl)-4-Propenyl naphthalene										
Trinitrophenol				14.*						
Trinitrophenol (2)				6.2*						
Trinitrophenol (3)				11.*						
Zytron			*		*		*	*	*	*

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site								
	12	D12	12	12	13	16	19	22	24
1-Pentylheptylbenzene								0.6*	
Perylene									
Phenanthrene/Anthracene	11.0	16.3	2.3	2.5	1.2	2.2	1.9	2.3	0.5
Phenol									
Phenylacetic Acids									
Pyrene		5.2	6.3	5.7	1.7		2.4	3.5	*
Tetrachlorobenzene	910.*	1000.*	1.6*	0.2*					
Tetrachlorobenzene (2)									
Tetrachlorobiphenyl (1)									
Tetrachlorobiphenyl (2)									
Tetrachlorobiphenyl (3)									
Tetrachlorobiphenyl (4)									
Tetrachlorobiphenyl (5)									
Tetradecanoic acid									
Tetradifon									
Tetramethylbenzene									0.3*
Tetramethylbenzene (2)									0.3*
(Tetramethylbutyl)phenol									
4(1,1,3,3-tetramethylbutyl) phenol									
Tetramethylnaphthalene			1.3*						
o-Toluidine	9.8*	9.9*							
p-Toluidine			0.9*	0.4*					
1,2,4,5-Triazine+2-Butyl-thiophene									
1,2,4-Trichlorobenzene	182.3	242.8	5.1	1.3					
Trichlorobiphenyl (1)									
Trichlorobiphenyl (2)									
Trichlorobiphenyl (3)									
2,3,3-Trimethylbutene									
Trimethyl-2-Cyclohexen-1-one									
4,4,5-Trimethyl-2-hexene									
Trimethylnaphthalene			1.6*						
Trimethylnaphthalene (2)									
Trimethylphenanthrene									
Trimethylphosphate									
(1,2,3-Trimethyl)-4-Propenyl naphthalene							1.2*		1.2*
Trinitrophenol									
Trinitrophenol (2)									
Trinitrophenol (3)									
Zytron									

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	26	D26	27	D27	31	32	33	35	37	40
1-Pentylheptylbenzene										
Perylene										
Phenanthrene/Anthracene	11.7	7.5	1.4	1.3	23.5	8.0	1.8	8.0	3.5	9.0
Phenol										
Phenylacetic Acids										
Pyrene	20.0	15.9	2.2	2.1	47.9	22.2	4.8	10.4	9.5	5.6
Tetrachlorobenzene										
Tetrachlorobenzene (2)										
Tetrachlorobiphenyl (1)					1.8	5.2				
Tetrachlorobiphenyl (2)					0.6	2.3			*	
Tetrachlorobiphenyl (3)					0.6	2.9			*	
Tetrachlorobiphenyl (4)					2.1	4.8		*	*	
Tetrachlorobiphenyl (5)										
Tetradecanoic acid										
Tetradifon					*	*		*		
Tetramethylbenzene	0.3*									
Tetramethylbenzene (2)	0.3*									
(Tetramethylbutyl)phenol	2.8*	1.3*								
4(1,1,3,3-tetramethylbutyl) phenol										
Tetramethylnaphthalene										
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2-Butylthiophene										
1,2,4-Trichlorobenzene										
Trichlorobiphenyl (1)						1.4				
Trichlorobiphenyl (2)						0.8				
Trichlorobiphenyl (3)						12.9				
2,3,3-Trimethylbutene										
Trimethyl-2-Cyclohexen-1-one										
4,4,5-Trimethyl-2-hexene										
Trimethylnaphthalene	0.8*	0.8*			5.6*	1.7*				
Trimethylnaphthalene (2)	0.9*	1.0*								
Trimethylphenanthrene						1.8*				
Trimethylphosphate										
(1,2,3-Trimethyl)-4-Propenyl naphthalene										
Trinitrophenol										
Trinitrophenol (2)										
Trinitrophenol (3)										
Zytron										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	41	43	44	45	48	51	52	53	54	55
1-Pentylheptylbenzene										
Perylene										
Phenanthrene/Anthracene	5.8	5.9	1.4	11.7		0.6	4.0	0.5	2.3	14.3
Phenol										
Phenylacetic Acids										
Pyrene	12.3	10.3	2.5	16.9	0.5	1.7	20.		0.6	49.6
Tetrachlorobenzene										
Tetrachlorobenzene (2)										
Tetrachlorobiphenyl (1)	*									
Tetrachlorobiphenyl (2)										
Tetrachlorobiphenyl (3)										
Tetrachlorobiphenyl (4)	*									
Tetrachlorobiphenyl (5)										
Tetradecanoic acid		71.5*								
Tetradifon	6.95						*	*		
Tetramethylbenzene										
Tetramethylbenzene (2)										
(Tetramethylbutyl)phenol										
4(1,1,3,3-tetramethylbutyl) phenol										
Tetramethylnaphthalene										
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2-Butyl-thiophene										
1,2,4-Trichlorobenzene										
Trichlorobiphenyl (1)										
Trichlorobiphenyl (2)										
Trichlorobiphenyl (3)										
2,3,3-Trimethylbutene										
Trimethyl-2-Cyclohexen-1-one										
4,4,5-Trimethyl-2-hexene										
Trimethylnaphthalene										
Trimethylnaphthalene (2)										
Trimethylphenanthrene										
Trimethylphosphate										
(1,2,3-Trimethyl)-4-Propenyl naphthalene										1.9*
Trinitrophenol										
Trinitrophenol (2)										
Trinitrophenol (3)										
Zytron										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	D55	56	D56	57	58	59	60	61	65	66
1-Pentylheptylbenzene										
Perylene										
Phenanthrene/Anthracene	16.7	8.6	11.9	4.2	5.8	5.7	11.8	1.2	1.2	0.8
Phenol										
Phenylacetic Acids										
Pyrene	48.8	2.5	13.5	5.5	14.0	7.5	10.5	1.6	5.7	2.7
Tetrachlorobenzene										
Tetrachlorobenzene (2)										
Tetrachlorobiphenyl (1)					0.5	*			*	
Tetrachlorobiphenyl (2)					1.4	*	*	*		
Tetrachlorobiphenyl (3)	*				1.3	*	*	*		
Tetrachlorobiphenyl (4)	*				2.2					
Tetrachlorobiphenyl (5)										
Tetradecanoic acid										
Tetradifon					*	*				
Tetramethylbenzene										
Tetramethylbenzene (2)										
(Tetramethylbutyl)phenol										
4(1,1,3,3-tetramethylbutyl) phenol										
Tetramethylnaphthalene										
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2-Butyl-thiophene										
1,2,4-Trichlorobenzene										
Trichlorobiphenyl (1)										
Trichlorobiphenyl (2)										
Trichlorobiphenyl (3)										
2,3,3-Trimethylbutene										
Trimethyl-2-Cyclohexen-1-one										
4,4,5-Trimethyl-2-hexene										
Trimethylnaphthalene					5.6*		1.7*			
Trimethylnaphthalene (2)										
Trimethylphenanthrene										
Trimethylphosphate										
(1,2,3-Trimethyl)-4-Propenyl-naphthalene	4.8*									
Trinitrophenol										
Trinitrophenol (2)										
Trinitrophenol (3)										
Zytron					*		*			

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	67	70	71	D71	72	73	74A	74B	75	76
1-Pentylheptylbenzene										
Perylene										
Phenanthrene/Anthracene	3.1	4.1	3.5	6.2	26.3	5.6	0.8	1.6	1.4	
Phenol						0.7*				
Phenylacetic Acids										
Pyrene	6.9	4.2	6.3	9.3	38.5	6.4	3.5	10.2	3.3	16.9
Tetrachlorobenzene										
Tetrachlorobenzene (2)										
Tetrachlorobiphenyl (1)						5.9				
Tetrachlorobiphenyl (2)	*					1.1				
Tetrachlorobiphenyl (3)	*					0.9				
Tetrachlorobiphenyl (4)	*					4.0				
Tetrachlorobiphenyl (5)										
Tetradecanoic acid										
Tetradifon										
Tetramethylbenzene										
Tetramethylbenzene (2)										
(Tetramethylbutyl)phenol										
4(1,1,3,3-tetramethylbutyl) phenol										
Tetramethylnaphthalene										
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2-Butyl-thiophene										
1,2,4-Trichlorobenzene										
Trichlorobiphenyl (1)										
Trichlorobiphenyl (2)										
Trichlorobiphenyl (3)										
2,3,3-Trimethylbutene										
Trimethyl-2-Cyclohexen-1-one										
4,4,5-Trimethyl-2-hexene							2.6*			1.1*
Trimethylnaphthalene		5.6*								
Trimethylnaphthalene (2)										
Trimethylphenanthrene										
Trimethylphosphate										
(1,2,3-Trimethyl)-4-Propenyl-naphthalene										
Trinitrophenol										
Trinitrophenol (2)										
Trinitrophenol (3)										
Zytron										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	78	80A	81	82	83	86	87	87A	89	89A
1-Pentylheptylbenzene										
Perylene										
Phenanthrene/Anthracene								1.8		
Phenol				3.1*						
Phenylacetic Acids										
Pyrene	0.5	0.8						5.8		
Tetrachlorobenzene		0.7*								0.2*
Tetrachlorobenzene ②										
Tetrachlorobiphenyl ①										
Tetrachlorobiphenyl ②								0.3		
Tetrachlorobiphenyl ③								2.0		
Tetrachlorobiphenyl ④										
Tetrachlorobiphenyl ⑤										
Tetradecanoic acid										
Tetradifon										
Tetramethylbenzene										
Tetramethylbenzene ②										
(Tetramethylbutyl)phenol										
4(1,1,3,3-tetramethylbutyl) phenol				18.*						
Tetramethylnaphthalene	1.5*									
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2-Butylthiophene		4.1*								
1,2,4-Trichlorobenzene		1.1						1.1		
Trichlorobiphenyl ①										
Trichlorobiphenyl ②										
Trichlorobiphenyl ③								1.0		
2,3,3-Trimethylbutene										
Trimethyl-2-Cyclohexen-1-one										
4,4,5-Trimethyl-2-hexene										
Trimethylnaphthalene	1.									
Trimethylnaphthalene ②	1.5*									
Trimethylphenanthrene								1.8*		
Trimethylphosphate										
(1,2,3-Trimethyl)-4-Propenylnaphthalene										
Trinitrophenol										
Trinitrophenol ②										
Trinitrophenol ③										
Zytron										

*Tentative identification and approximate quantitation

Table 2 (cont.)

Parameter	Sampling Site									
	90	91A	91B	91C	92	D92	95			
1-Pentylheptylbenzene										
Perylene										
Phenanthrene/Anthracene					3.2	4.4	0.22			
Phenol										
Phenylacetic Acids										
Pyrene					13.9	11.4				
Tetrachlorobenzene		0.2*		0.1*						
Tetrachlorobenzene (2)							1.1*			
Tetrachlorobiphenyl (1)										
Tetrachlorobiphenyl (2)										
Tetrachlorobiphenyl (3)										
Tetrachlorobiphenyl (4)					*					
Tetrachlorobiphenyl (5)										
Tetradecanoic acid										
Tetradifon										
tetramethylbenzene										
Tetramethylbenzene (2)										
(Tetramethylbutyl)phenol										
4(1,1,3,3-tetramethylbutyl) phenol										
Tetramethylnaphthalene										
o-Toluidine										
p-Toluidine										
1,2,4,5-Triazine+2+Butyl-thiophene										
1,2,4-Trichlorobenzene		0.7		0.3						
Trichlorobiphenyl (1)										
Trichlorobiphenyl (2)										
Trichlorobiphenyl (3)										
2,3,3-Trimethylbutene		0.9*								
Trimethyl-2-Cyclohexen-1-one	0.8*									
4,4,5-Trimethyl-2-hexene										
Trimethylnaphthalene										
Trimethylnaphthalene (2)										
Trimethylphenanthrene										
Trimethylphosphate						6.1*				
(1,2,3-Trimethyl)-4-Propenyl-naphthalene										
Trinitrophenol										
Trinitrophenol (2)										
Trinitrophenol (3)										
Zytron										

*Tentative identification and approximate quantitation

Table 3

Concentrations of PCBs and Pesticides in Sediments
of the Buffalo and Niagara Rivers, New York - 1981.
(All values are mg/kg dry weight)

Parameter	Sampling Site								
	01	02	03	04	05	07	08	10	11
Aroclor 1248	<0.04	<0.06	0.04	<0.05	0.06	<0.03	0.07	0.09	0.12
Aroclor 1254	<0.02	------	------	------	------	------	------	------	----->
Aroclor 1260	<0.02	------	------	------	------	------	------	------	----->
Total PCBs	<0.04	<0.06	0.04	<0.05	0.06	<0.03	0.07	0.09	0.12
o,p - DDE	<0.022	------	------	------	------	------	------	------	----->
p,p - DDE	0.001	0.002	0.012	0.019	0.014	<0.001	------	----->	0.013
o,p - DDD	<0.003	<0.003	0.003	0.005	0.007	<0.003	<0.003	0.004	0.006
p,p - DDD	0.006	0.007	0.005	0.005	0.012	0.003	0.003	0.012	0.014
o,p - DDT	<0.008	<0.008	0.009	0.008	0.009	<0.008	------	------	----->
p,p - DDT	0.004	<0.004	0.017	0.012	0.007	0.004	0.004	0.006	<0.004
Total DDT	0.011	0.009	0.046	0.049	0.049	0.007	0.007	0.022	0.033
gamma - Chlordane	0.004	0.005	0.014	0.015	0.013	0.004	0.007	0.006	0.013
alpha - Chlordane	<0.002	------	------	------	------	------	------	------	----->
oxy - Chlordane	<0.004	------	----->	0.006	0.010	<0.004	0.006	0.004	0.007
Total Chlordane	0.004	0.005	0.014	0.021	0.023	0.004	0.013	0.010	0.020
DCPA	0.036	0.027	<0.006	------	------	----->	0.006	<0.006	<0.006
Heptachlor Epoxide	<0.002	<0.002	0.018	0.030	0.034	<0.002	0.002	0.002	0.017
beta - BHC	0.006	0.008	0.033	0.046	0.038	0.007	0.016	<0.006	0.088
gamma - BHC (Lindane)	<0.002	------	------	------	------	------	------	------	----->
Hexachlorobenzene	<0.002	------	------	------	------	------	------	------	----->
Mirex	0.003	0.007	0.003	0.004	0.005	<0.003	------	----->	0.004
Methoxychlor	<0.02	<0.02	0.02	0.286	0.147	0.597	0.640	0.039	<0.02
Aldrin	<0.002	------	------	------	------	------	------	------	----->
Dieldrin	<0.001	0.002	<0.001	------	------	------	------	----->	0.001
Endrin	<0.002	------	------	------	------	------	------	------	----->
alpha-Endosulfan	<0.002	------	------	------	------	------	----->	0.002	<0.002
beta-Endosulfan	<0.009	0.013	<0.009	------	------	----->	0.011	0.009	0.012
Zytron	<0.012	<0.012	0.069	0.030	<0.012	0.008	<0.012	------	----->
Di-N-Butyl Phthalate	0.771	0.802	0.377	0.368	0.342	0.539	0.567	0.352	0.349
Trifluralin	<0.005	----->	0.009	0.005	0.008	<0.005	----->	0.017	0.006
Chlorobenzilate	<0.009	------	------	------	------	------	------	----->	0.009

Table 3 (cont.)

Parameter	Sampling Site								
	12	12	12	12	13	16	19	22	24
				Bottom					
Aroclor 1248	1.72	0.26	1.39	1.19	0.02	0.015	0.02	0.036	0.024
Aroclor 1254	1.45	0.4	0.75	0.82	0.053	0.034	0.059	0.0998	0.043
Aroclor 1260	<0.054	0.56	0.64	0.61	------	------	----->	0.054	<0.054
Total PCBs	3.17	1.22	2.78	2.62	0.073	0.049	0.079	0.1898	0.067
o,p - DDE	<0.022	<0.001	------	------	------	------	------	-------	----->
p,p - DDE	0.082	0.125	0.015	0.16	0.005	0.005	0.002	0.007	0.004
o,p - DDD	0.05	16.09*	0.001	0.004	0.001	<0.001	<0.001	0.002	<0.001
p,p - DDD	<0.002	0.353	<0.001	<0.001	0.01	0.003	0.002	0.012	0.01
o,p - DDT	<0.005	<0.003	0.008	0.012	0.009	0.005	<0.005	-------	----->
p,p - DDT	0.011	1.84	0.007	0.005	0.008	0.008	0.001	0.006	0.006
Total DDT	0.143	2.318	0.03	0.04	0.033	0.021	0.005	0.027	0.020
gamma - Chlordane	0.088	0.301	0.008	0.010	0.004	0.002	0.001	0.004	0.003
alpha - Chlordane	<0.002	------	------	------	------	------	------	-------	----->
oxy - Chlordane	<0.001	<0.001	------	----->	0.003	0.001	<0.001	0.006	0.004
Total Chlordane	0.088	0.301	0.008	0.010	0.007	0.003	0.001	0.010	0.007
DCPA	<0.002	<0.001	<0.001	0.003	------	------	------	-------	----->
Heptachlor Epoxide	0.147	0.216	0.005	0.005	0.004	0.003	0.002	0.006	0.004
beta - BHC	<0.006	0.135	0.006	<0.001	0.014	0.006	<0.006	0.014	0.009
gamma - BHC (Lindane)	<0.001	0.298	<0.001	0.008	------	------	------	-------	----->
Hexachlorobenzene	1.14	58.713	0.626	0.672	0.006	0.001	<0.001	<0.001	<0.001
Mirex	0.05	0.266	0.008	0.082	<0.001	------	------	-------	----->
Methoxychlor	<0.008	<0.002	<0.002	0.136	<0.008	0.02	<0.008	0.017	0.008
Aldrin	<0.002	<0.001	------	----->	<0.002	------	------	-------	----->
Dieldrin	0.083	<0.001	------	------	------	------	------	-------	----->
Endrin	0.267	<0.003	------	----->	<0.2	------	------	-------	----->
alpha-Endosulfan	0.015	------	------	----->	<0.01	------	------	-------	----->
beta-Endosulfan	0.074	0.153	0.01	0.019	<0.001	------	------	-------	----->
Zytron	0.577	<0.001	0.018	0.037	<0.006	0.006	0.007	0.018	0.012
Di-N-Butyl Phthalate	0.536	2.09	0.07	0.372	0.492	0.563	0.091	0.149	0.09
Trifluralin	<0.002	0.053	<0.005	----->	<0.002	------	------	-------	----->
Chlorobenzilate	<0.002	------	------	------	------	------	------	-------	----->

*Not confirmed by GC/MS

Table 3 (cont.)

Parameter	Sampling Site								
	26	27	31	32	33	35	37	40	41
Aroclor 1248	0.84	<0.27	<0.27	7.4	0.71	<0.27	0.77	0.68	0.34
Aroclor 1254	1.28	0.08	2.4	7.5	0.54	0.41	1.09	0.53	0.39
Aroclor 1260	<0.054	0.04	0.69	1.35	0.12	0.02	0.38	0.13	0.11
Total PCBs	2.12	0.12	3.09	16.25	1.37	0.43	2.24	1.34	0.84
o,p - DDE	0.022	0.04	<0.02	0.663	0.118	0.172	0.117	0.113	0.079
p,p - DDE	0.069	0.032	<0.018	0.218	0.027	<0.018	0.018	0.036	0.028
o,p - DDD	<0.001	0.01	<0.01	0.294	0.011	0.03	0.018	0.023	0.019
p,p - DDD	0.075	0.02	<0.014	0.231	0.053	0.014	0.066	0.054	0.025
o,p - DDT	<0.005	0.022	<0.02	<0.02	<0.02	0.039	<0.02	------	----->
p,p - DDT	0.039	0.044	<0.02	<0.02	------	------	------	----->	0.022
Total DDT	0.205	0.168	<0.02	1.406	0.209	0.255	0.219	0.226	0.173
gamma - Chlordane	0.012	0.01	<0.01	0.130	0.03	0.021	0.047	0.027	0.023
alpha - Chlordane	<0.002	------	------	------	------	------	------	------	----->
oxy - Chlordane	<0.001	0.006	<0.006	0.896	0.055	0.107	0.026	0.054	<0.006
Total Chlordane	0.012	0.016	<0.006	1.026	0.085	0.128	0.073	0.081	0.023
DCPA	<0.002	0.002	0.005	0.007	0.006	0.002	0.004	0.005	0.005
Heptachlor Epoxide	0.091	0.30	<0.01	0.301	0.023	0.042	0.014	0.023	0.022
beta - BHC	<0.006	0.013	<0.01	<0.01	0.055	<0.01	0.038	0.052	<0.01
gamma - BHC (Lindane)	<0.001	0.004	<0.004	0.734	<0.004	0.044	<0.004	----->	0.05
Hexachlorobenzene	<0.001	0.002	<0.002	0.101	<0.002	0.003	<0.002	----->	0.006
Mirex	<0.001	<0.004	0.017	<0.004	----->	0.009	----->	0.004	0.01
Methoxychlor	0.127	0.037	<0.03	0.139	<0.03	------	------	----->	0.04
Aldrin	<0.002	------	------	------	------	------	------	------	----->
Dieldrin	<0.001	----->	0.012	0.012	<0.001	------	------	------	----->
Endrin	<0.02	<0.003	----->	<0.003	0.003	<0.003	------	------	----->
alpha-Endosulfan	<0.01	<0.001	----->	<0.001	------	------	------	------	----->
beta-Endosulfan	<0.001	0.003	0.014	0.014	0.006	0.018	0.013	0.01	0.016
Zytron	0.273	0.044	<0.04	3.902	<0.04	0.463	<0.04	0.292	<0.04
Di-N-Butyl Phthalate	0.497	<0.4	----->	<0.04	------	------	------	------	----->
Trifuralin	<0.002	<0.06	----->	<0.06	------	------	------	----->	0.064
Chlorbenzilate	<0.002	------	------	------	------	------	------	------	----->

Table 3 (cont.)

Parameter	Sampling Site								
	43	44	45	48	51	52	53	54	55
Aroclor 1248	0.27	0.14	0.12	0.07	0.09	0.33	0.10	0.14	0.08
Aroclor 1254	0.36	<0.02	----->	<0.02	------	------	------	------	----->
Aroclor 1260	0.11	<0.02	----->	<0.02	------	------	------	------	----->
Total PCBs	0.74	0.14	0.12	0.07	0.09	0.33	0.10	0.14	0.08
o,p - DDE	0.061	0.021	0.035	0.006	0.012	0.039	0.012	0.04	0.10
p,p - DDE	0.027	0.01	0.05	0.007	0.011	0.03	0.018	0.027	0.125
o,p - DDD	0.016	0.005	0.01	0.001	0.007	0.024	0.005	0.009	0.012
p,p - DDD	0.025	0.015	0.063	<0.01	0.012	0.102	0.028	0.075	0.238
o,p - DDT	<0.02	<0.2	------	------	------	------	------	----->	0.2
p,p - DDT	0.024	0.007	0.008	<0.007	0.009	0.014	0.036	0.018	<0.007
Total DDT	0.153	0.058	0.166	0.014	0.051	0.209	0.099	0.169	0.675
gamma - Chlordane	0.022	0.011	0.029	<0.006	0.009	0.041	0.006	0.007	0.014
alpha - Chlordane	<0.002	------	------	------	------	------	------	------	----->
oxy - Chlordane	<0.006	0.004	0.013	<0.003	0.004	0.011	0.006	0.011	<0.003
Total Chlordane	0.022	0.015	0.045	<0.006	0.013	0.052	0.012	0.018	0.014
DCPA	0.015	<0.002	------	------	------	------	------	------	----->
Heptachlor Epoxide	0.02	0.01	0.02	0.01	0.009	0.018	0.018	0.017	0.014
beta - BHC	<0.01	0.023	0.07	<0.01	0.019	0.066	0.01	0.019	<0.01
gamma - BHC (Lindane)	0.008	<0.002	----->	<0.002	------	------	------	------	----->
Hexachlorobenzene	0.004	0.002	<0.002	<0.002	------	------	------	------	----->
Mirex	0.011	0.003	0.02	0.002	0.003	0.01	0.004	0.007	0.03
Methoxychlor	<0.03	<0.002	----->	0.002	<0.002	<0.002	0.008	0.217	<0.002
Aldrin	<0.002	------	------	------	------	------	------	------	----->
Dieldrin	<0.001	------	------	------	------	------	------	------	----->
Endrin	0.005	<0.002	------	------	------	------	------	------	------
alpha-Endosulfan	<0.001	------	------	------	------	----->	0.001	0.001	----->
beta-Endosulfan	<0.003	0.004	<0.004	<0.004	0.005	0.01	<0.004	0.007	0.029
Zytron	<0.04	0.081	0.21	0.015	0.055	0.18	0.036	0.045	0.253
Di-N-Butyl Phthalate	0.474	0.616	1.76	0.77	0.55	0.93	1.08	0.95	1.37
Trifluralin	<0.06	0.022	0.008	<0.008	----->	0.038	<0.008	------	----->
Chlorobenzilate	<0.002	------	------	------	------	------	------	------	----->

Table 3 (cont.)

Parameter	Sampling Site								
	56	57	58	59	60	61	65	66	67
Aroclor 1248	0.05	0.09	0.73	0.94	0.08	0.02	0.04	0.05	0.32
Aroclor 1254	0.09	0.13	0.61	1.02	0.16	0.11	0.06	0.10	0.36
Aroclor 1260	0.09	0.04	0.34	0.44	0.06	0.07	0.03	0.06	0.17
Total PCBs	0.23	0.26	1.68	2.40	0.30	0.20	0.13	0.21	0.85
o,p - DDE	0.04	0.07	0.05	0.16	0.10	0.01	0.02	0.03	0.10
p,p - DDE	<0.01	0.07	0.03	0.09	0.09	0.006	0.01	0.02	0.02
o,p - DDD	<0.002	0.03	0.02	0.05	0.02	0.002	0.006	0.01	0.03
p,p - DDD	<0.01	0.01	<0.01	0.06	0.06	0.013	0.024	0.02	0.02
o,p - DDT	<0.002	------	------	------	------	------	------	------	----->
p,p - DDT	<0.002	0.01	0.003	0.01	0.007	0.002	0.003	0.006	0.017
Total DDT	0.04	0.19	0.103	0.37	0.277	0.033	0.063	0.086	0.187
gamma - Chlordane	<0.003	0.02	<0.003	<0.003	0.01	0.003	0.003	0.004	0.03
alpha - Chlordane	<0.002	------	------	------	------	------	------	------	----->
oxy - Chlordane	<0.002	0.01	0.01	0.05	0.01	<0.002	0.002	0.004	0.044
Total Chlordane	<0.003	0.03	0.01	0.05	0.02	0.003	0.005	0.008	0.047
DCPA	<0.002	------	------	------	------	------	------	------	----->
Heptachlor Epoxide	<0.006	0.04	0.03	0.12	0.03	0.006	0.008	0.014	0.07
beta - BHC	<0.01	------	----->	0.13	0.11	0.015	0.013	0.01	0.04
gamma - BHC (Lindane)	<0.001	0.006	0.008	0.04	0.006	<0.001	------	----->	0.02
Hexachlorobenzene	<0.001	0.004	0.002	0.02	0.005	<0.001	------	----->	0.003
Mirex	0.011	0.15	0.02	0.01	0.03	0.012	0.002	0.003	0.007
Methoxychlor	<0.03	<0.03	0.03	<0.03	------	------	------	------	----->
Aldrin	<0.002	------	------	------	------	------	------	------	----->
Dieldrin	<0.002	------	------	------	------	------	------	------	----->
Endrin	<0.001	------	----->	<0.002	------	------	------	------	----->
alpha-Endosulfan	<0.003	------	------	------	------	------	------	------	----->
beta-Endosulfan	0.009	0.023	0.043	<0.003	0.02	0.003	0.004	0.004	0.007
Zytron	<0.016	0.06	0.06	0.26	0.05	0.016	0.01	0.02	0.22
Di-N-Butyl Phthalate	<0.08	------	----->	<0.08	0.15	0.17	0.08	0.14	0.18
Trifluralin	<0.002	------	------	------	------	------	------	------	----->
Chlorobenzilate	<0.002	------	------	------	------	------	------	------	----->

Table 3 (cont.)

Parameter	Sampling Site								
	70	71	72	73	74A	74B	75	76	78
Aroclor 1248	0.23	0.09	10.2	8.62	1.37	0.03	2.73	0.94	2.03
Aroclor 1254	0.15	0.17	7.8	9.0	1.25	<0.02	0.78	0.29	1.21
Aroclor 1260	0.06	0.29	2.5	2.71	0.73	<0.02	0.16	0.10	0.55
Total PCBs	0.44	0.55	20.5	20.33	3.35	0.03	3.67	1.33	3.79
o,p - DDE	0.017	0.013	0.035	0.73	0.004	<0.001	0.067	0.022	0.09
p,p - DDE	<0.003	0.003	0.034	0.18	0.004	<0.001	0.036	<0.003	<0.003
o,p - DDD	0.009	0.005	0.036	0.53	0.003	0.001	0.017	0.012	0.114
p,p - DDD	0.024	0.022	<0.001	0.34	0.001	0.004	0.014	<0.01	0.165
o,p - DDT	<0.002	<0.002	<0.003	<0.002	0.004	<0.003	<0.002	------	----->
p,p - DDT	0.003	0.021	0.035	0.098	<0.001	<0.001	0.002	<0.002	<0.002
Total DDT	0.053	0.064	0.140	1.878	0.02	0.005	0.136	0.034	0.369
gamma - Chlordane	0.009	0.004	0.073	<0.004	0.003	0.004	<0.004	----->	0.102
alpha - Chlordane	<0.002	------	------	------	------	------	------	------	----->
oxy - Chlordane	<0.03	<0.03	<0.001	1.71	0.004	<0.001	0.033	0.033	0.11
Total Chlordane	0.009	0.002	0.073	1.71	0.007	0.004	0.033	0.033	0.11
DCPA	0.002	0.002	<0.002	<0.001	0.001	<0.001	------	----->	0.006
Heptachlor Epoxide	0.004	0.004	<0.002	1.0	0.003	<0.001	0.034	0.025	0.019
beta - BHC	0.055	0.014	<0.008	1.23	0.007	0.002	<0.01	<0.01	0.127
gamma - BHC (Lindane)	<0.01	<0.01	<0.004	3.25	0.001	<0.001	0.015	0.031	<0.01
Hexachlorobenzene	<0.002	<0.002	0.152	0.48	0.038	0.003	0.002	0.006	<0.002
Mirex	0.004	0.017	<0.002	0.002	0.002	0.005	0.004	0.003	0.017
Methoxychlor	<0.002	<0.002	0.083	<0.002	0.005	0.002	<0.002	------	----->
Aldrin	<0.002	----->	<0.002	<0.002	<0.001	0.001	<0.002	------	----->
Dieldrin	0.002	0.003	<0.001	<0.001	------	----->	0.002	<0.001	0.005
Endrin	0.001	<0.001	<0.003	<0.001	<0.003	----->	0.004	<0.001	------
alpha-Endosulfan	<0.001	<0.001	<0.02	<0.001	<0.02	----->	<0.001	------	----->
beta-Endosulfan	0.003	<0.003	<0.003	<0.003	0.003	0.006	0.006	<0.003	<0.003
Zytron	0.079	0.005	0.133	6.89	0.023	0.005	0.167	0.154	0.605
Di-N-Butyl Phthalate	0.27	0.24	1.54	0.05	0.052	0.026	0.33	0.24	0.68
Trifluralin	<0.002	----->	0.056	<0.002	<0.005	----->	<0.002	------	----->
Chlorobenzilate	<0.002	------	------	------	------	------	------	------	----->

Table 3 (cont.)

Parameter	Sampling Site								
	80A	81	82	83	86	87	87A	89	89A
Aroclor 1248	0.03	0.70	2.82	1.05	0.57	2.84	1.39	0.07	0.03
Aroclor 1254	<0.02	0.38	1.66	0.28	0.22	1.02	0.61	0.02	<0.02
Aroclor 1260	<0.02	0.10	1.33	0.13	0.11	0.21	0.31	0.01	<0.02
Total PCBs	0.03	1.18	5.81	1.46	0.90	4.07	2.31	0.10	0.03
o,p - DDE	0.005	0.042	<0.003	0.029	0.091	0.175	<0.001	0.003	<0.001
p,p - DDE	0.002	0.02	0.28	0.047	0.058	0.068	<0.001	0.002	<0.001
o,p - DDD	0.002	0.009	0.13	0.012	0.044	0.049	0.012	0.001	<0.001
p,p - DDD	<0.001	0.024	0.344	0.066	0.023	0.033	<0.001	<0.001	----->
o,p - DDT	0.005	<0.002	<0.003	------	------	----->	0.025	<0.003	<0.003
p,p - DDT	<0.001	0.11	0.416	0.019	0.012	0.017	0.093	<0.01	<0.001
Total DDT	0.014	0.205	1.17	0.173	0.228	0.342	0.13	0.006	<0.003
gamma - Chlordane	0.005	<0.004	<0.001	0.013	0.024	<0.001	0.005	<0.001	<0.001
alpha - Chlordane	<0.002	----->	<0.002	------	------	------	----->	<0.002	----->
oxy - Chlordane	<0.001	0.028	0.082	0.041	0.054	0.148	0.016	0.002	<0.001
Total Chlordane	0.005	0.028	0.082	0.054	0.078	0.148	0.021	0.002	<0.002
DCPA	0.001	0.24	<0.002	------	------	----->	0.008	<0.002	<0.001
Heptachlor Epoxide	0.002	0.023	0.027	0.007	0.057	0.158	0.011	<0.002	<0.001
beta - BHC	0.002	<0.01	<0.008	<0.008	0.039	0.081	0.006	<0.008	0.002
gamma - BHC (Lindane)	<0.001	0.027	0.048	<0.004	------	----->	<0.001	<0.004	<0.001
Hexachlorobenzene	0.04	0.004	0.019	<0.001	------	----->	0.069	<0.001	0.004
Mirex	<0.001	<0.002	0.007	0.002	------	----->	0.025	<0.002	<0.001
Methoxychlor	0.015	<0.002	<0.001	------	------	----->	<0.002	<0.001	<0.002
Aldrin	0.002	<0.002	<0.002	------	------	----->	<0.001	<0.002	<0.001
Dieldrin	<0.001	0.26	<0.001	------	------	------	----->	<0.001	----->
Endrin	<0.003	<0.001	<0.003	------	------	------	----->	<0.003	----->
alpha-Endosulfan	<0.02	0.07	0.028	<0.02	------	------	----->	<0.02	----->
beta-Endosulfan	0.005	0.20	<0.003	0.005	<0.003	0.004	0.015	<0.003	<0.001
Zytron	0.008	0.127	0.165	0.192	0.225	0.65	0.180	0.012	0.004
Di-N-Butyl Phthalate	0.096	1.7	0.44	0.048	0.027	0.162	0.925	0.221	0.062
Trifluralin	<0.005	<0.002	<0.02	------	------	----->	<0.005	<0.02	<0.005
Chlorobenzilate	<0.002	------	------	------	------	------	------	------	----->

Table 3 (cont.)

Parameter	Sampling Site							
	90	91A	91B	91C	92	95		
Aroclor 1248	0.19	0.01	0.005	0.03	0.49	0.23		
Aroclor 1254	0.08	<0.02	<0.02	<0.02	0.26	0.03		
Aroclor 1260	0.02	<0.02	<0.02	<0.02	0.15	0.04		
Total PCBs	0.29	0.01	0.005	0.03	0.90	0.30		
o,p - DDE	0.031	<0.001	<0.001	<0.001	0.054	0.03		
p,p - DDE	0.015	<0.001	<0.001	<0.001	0.031	0.004		
o,p - DDD	0.017	<0.001	0.017	<0.001	0.012	<0.001		
p,p - DDD	0.002	<0.001	0.001	<0.001	0.098	<0.001		
o,p - DDT	<0.003	----->	<0.003	<0.003	----->	0.003		
p,p - DDT	0.014	<0.001	<0.001	----->	0.016	0.031		
Total DDT	0.079	<0.003	0.018	<0.003	0.211	0.068		
gamma - Chlordane	<0.001	<0.001	0.001	<0.001	0.062	<0.001		
alpha - Chlordane	<0.002	----->	<0.002	------	------	----->		
oxy - Chlordane	0.011	<0.001	<0.001	----->	0.024	<0.001		
Total Chlordane	0.011	<0.002	0.001	<0.002	0.086	<0.001		
DCPA	<0.002	<0.001	<0.001	<0.001	<0.002	----->		
Heptachlor Epoxide	0.002	<0.001	<0.001	<0.001	0.007	0.002		
beta - BHC	0.008	0.005	<0.001	0.004	0.289	<0.008		
gamma - BHC (Lindane)	<0.004	<0.001	<0.001	----->	0.023	0.004		
Hexachlorobenzene	<0.001	0.006	0.018	0.013	0.111	0.021		
Mirex	<0.002	0.026	<0.001	0.044	1.89	<0.002		
Methoxychlor	<0.001	<0.002	<0.002	<0.002	<0.001	0.282		
Aldrin	<0.002	0.001	<0.001	0.002	<0.002	----->		
Dieldrin	0.001	<0.001	<0.001	----->	<0.001	----->		
Endrin	<0.003	----->	<0.003	------	----->	0.003		
alpha-Endosulfan	<0.02	----->	<0.02	------	------	----->		
beta-Endosulfan	<0.003	<0.001	0.002	0.002	0.005	0.003		
Zytron	0.045	<0.001	0.002	0.003	0.181	0.025		
Di-N-Butyl Phthalate	0.187	0.077	0.026	0.035	0.195	0.147		
Trifluralin	<0.02	<0.005	<0.005	----->	<0.02	0.021		
Chlorobenzilate	<0.002	----->	<0.002	------	------	----->		

Table 4

Concentrations of Metals in Sediments of the Buffalo and Niagara Rivers, New York - 1981. (All values are mg/kg dry weight)

Parameter	Sampling Site								
	01	02	03	04	05	07	08	10	11
Cadmium	<0.2	0.32	0.33	0.28	0.47	0.27	0.29	0.64	1.80
Chromium	17	18	24	14	19	15	15	18	37
Copper	38	41	28	24	36	32	33	55	57
Lead	44	46	250	89	150	36	41	140	78
Mercury	0.3	0.1	0	0.1	0.1	0.1	0.1	0.3	0.4
Nickel	33	32	21	19	23	25	24	32	33
Zinc	130	160	93	100	150	110	110	150	170
Silver	<0.3	<0.3	0.3	0.31	<0.3	<0.3	<0.3	<0.3	<0.3
Boron	10.0	<8.0	8.0	8.1	<8.0	<8.0	<8.0	<8.0	<8.0
Barium	96	94	48	60	78	78	75	110	91
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	11.0	12.0	8.2	7.5	9	11	10	13	12
Lithium	29	32	17	18	21	23	23	27	30
Manganese	430	500	270	390	510	540	490	580	680
Molybdenum	4.4	1.5	1.7	<1.0	<1.0	1.7	<1.0	<1.0	1.9
Tin	<4.0	<4.0	<4.0	4.7	10.0	<4.0	<4.0	<4.0	5.9
Strontium	36	27	26	31	37	32	30	36	46
Vanadium	21	20	12	14	17	17	16	18	20
Yttrium	11	11	7.1	8.1	10	10	10	10	11

(All values are g/kg dry weight)

Parameter	01	02	03	04	05	07	08	10	11
Calcium	23	17	19	22	26	21	19	23	26
Potassium	1.7	1.7	0.9	1.0	1.0	1.2	1.2	1.2	2.2
Magnesium	6.8	6.9	6.4	6.1	6.6	7.1	6.7	8.4	10
Sodium	0.11	0.10	<0.10	0.10	0.10	0.11	<0.10	0.72	0.48
Aluminum	13.0	13.0	7.0	8.1	9	10	10	11	12
Iron	26	27	17	16	20	22	21	27	32

Table 4 (Cont.)

Parameter	Sampling Site								
	12	12	12	12 Bottom	13	16	19	22	24
Cadmium	2.8	2.8	1.3		0.50	0.32	0.9	1.5	1.1
Chromium	130	1000	44		25	16	23	36	36
Copper	220	1200	69		40	36	36	51	54
Lead	360	3300	120		60	36	70	90	92
Mercury	0.8	24	0.8	1.2	0.2	0.3	0.3	0.4	0.6
Nickel	46	120	33		31	30	25	31	31
Zinc	600	540	180		140	120	140	210	230
Silver	<0.3	<0.3	<0.3		<0.3	<0.3	<0.3	<0.3	<0.3
Boron	9.2	16	<8		8.9	<8.0	<8.0	9.8	9.7
Barium	120	89	92		87	96	66	93	94
Beryllium	<0.1	4.10	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	12	16	11		11	12	9	12	12
Lithium	23	10	28		28	28	21	28	31
Manganese	1000	720	600		570	670	370	500	510
Molybdenum	5.9	27	3.8		1.6	1.0	1.1	<1.0	1.2
Tin	14	16	5		<4	<4	<4	5	7
Strontium	82	43	44		35	33	31	41	41
Vanadium	22	25	19		21	20	16	22	22
Yttrium	10	4.6	10		12	12	9.3	11	12
(All values are g/kg dry weight)									
Calcium	44	21	28		23	21	21	30	27
Potassium	1.4	0.58	1.40		1.7	1.4	1.2	1.7	1.7
Magnesium	7.9	4.2	8.2		9.5	9.1	6.5	9.4	10.0
Sodium	0.56	0.61	0.64		0.14	0.10	0.11	0.14	0.15
Aluminum	10	5.2	12.0		12	12	9	13	13
Iron	45	7.3	30		27	26	21	28	29

Table 4 (Cont.)

Parameter	Sampling Site								
	26	27	31	32	33	35	37	40	41
Cadmium	4.5	1	12	25	14	4.5	17.0	8.9	8.5
Chromium	54	40	180	260	200	68	410	130	98
Copper	140	59	340	310	200	210	1500	140	150
Lead	300	98	950	840	430	230	680	420	390
Mercury	1.3	0.6	1.4	3.0	1.3	0.3	1.7	1.6	2.4
Nickel	39	36	51	68	47	37	66	48	42
Zinc	390	240	1200	1300	670	710	1400	530	490
Silver	3.5	<0.3	6.7	8.5	3.8	0.9	8.0	2.8	3.4
Boron	<8.0	9.0	17	13	17	14	12	16	10
Barium	140	100	260	320	220	300	460	180	180
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	12	13	11	12	11	6.4	11.0	11.0	9.9
Lithium	24	35	26	30	30	16	28	34	29
Manganese	410	510	670	360	370	620	400	420	410
Molybdenum	6.5	1.3	1.9	2.0	1.3	2.1	1.8	1.4	1.8
Tin	20	6	99	52	34	4	50	17	16
Strontium	44	39	200	91	91	260	110	78	71
Vanadium	19	25	38	36	33	15	29	33	25
Yttrium	9.3	12	11	12	12	7	12	12	11
(All values are g/kg dry weight)									
Calcium	27	24	58	37	43	77	48	39	39
Potassium	1.2	2.2	2.2	2.2	2.8	0.9	2.4	3.5	2.2
Magnesium	9.4	10	12	12	12	13	11	12	11
Sodium	0.13	0.14	0.30	0.22	0.26	0.28	0.42	0.24	0.20
Aluminum	10	16	16	17	17	9	17	18	14
Iron	26	31	30	30	26	17	29	28	25

Table 4 (Cont.)

Parameter	Sampling Site								
	43	44	45	48	51	52	53	54	55
Cadmium	6.2	2.3	1.1	0.26	0.42	4.00	1.10	0.45	0.7
Chromium	74	45	50	23	31	95	37	34	69
Copper	110	55	66	43	53	120	61	76	44
Lead	260	120	230	79	68	190	85	100	100
Mercury	4.2	2.1	0.8	0.5	1.3	3.4	0.6	1.4	0.5
Nickel	40	31	29	33	36	39	37	23	30
Zinc	410	260	340	220	170	470	200	260	590
Silver	1.30	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Boron	8.8	<8.0	<8.0	<8.0	13	10	8.8	<8.0	10
Barium	150	83	110	89	120	120	110	100	89
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	10	9	8	12	13	13	13	6.8	11
Lithium	33	29	28	39	44	44	38	32	29
Manganese	620	630	680	440	610	420	550	420	1500
Molybdenum	<1.0	<1.0	1.2	<1.0	1.4	<1.0	1.8	<1.0	<1.0
Tin	13	6.3	7.7	<4.0	4.3	8.7	4.1	<4.0	6
Strontium	77	56	64	36	42	40	41	34	88
Vanadium	25	19	20	23	28	32	25	23	35
Yttrium	11	10	10	13	14	13	13	9.2	10
(All values are g/kg dry weight)									
Calcium	40	33	41	22	24	21	25	19	50
Potassium	2.3	1.6	1.6	2.1	3.6	3.0	2.1	1.7	2.3
Magnesium	11	9	11	10	9.9	11	9.9	9.6	11
Sodium	0.25	0.20	0.33	0.14	0.18	0.21	0.14	0.13	0.20
Aluminum	16	13	14	15	18	18	15	15	12
Iron	26	23	24	29	31	35	32	31	39

Table 4 (Cont.)

Parameter	Sampling Site								
	56	57	58	59	60	61	65	66	67
Cadmium	0.8	1.6	3.8	4.2	2.0	0.3	1.2	2.2	5.0
Chromium	75	63	47	78	89	72	61	66	100
Copper	47	140	120	130	71	33	52	67	180
Lead	110	420	1200	1100	290	55	130	210	140
Mercury	0.3	0.2	0.5	0.6	0.8	0.1	0.6	0.5	0.4
Nickel	33	44	29	50	38	28	34	40	34
Zinc	550	920	2000	3300	1500	390	580	720	440
Silver	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.3
Boron	<8	29	18	28	8.6	<8.0	9.7	8.1	<8.0
Barium	73	92	120	120	73	52	96	140	88
Beryllium	<0.1	3.9	<0.1	10	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	10	6.8	6.9	12	11	7.6	11	11	8.5
Lithium	27	8	16	20	21	15	24	26	20
Manganese	1700	3200	1900	2800	2200	2200	1100	1500	390
Molybdenum	<1.0	2.2	1.1	2.2	2.2	1.5	<1.0	<1.0	<1.0
Tin	4	31	35	16	12	6.2	5.6	8.4	7.5
Strontium	70	67	99	110	74	55	91	130	56
Vanadium	34	26	27	60	37	31	30	31	17
Yttrium	9.1	3.8	6.7	8.1	8.3	6.1	13	15	7.8
(All values are g/kg dry weight)									
Calcium	47	33	50	64	49	39	50	70	31
Potassium	1.6	1.9	1.4	1.4	1.1	0.7	1.6	1.6	1.3
Magnesium	9.8	10	9.7	11	11	8	11	10	10
Sodium	0.13	0.59	0.28	0.1	0.1	0.1	0.2	0.2	0.1
Aluminum	11	6	13	14	10	6.6	13	13	85
Iron	39	110	72	73	66	50	36	38	20

Table 4 (Cont.)

Parameter	Sampling Site								
	70	71	72	73	74A	74B	75	76	78
Cadmium	1.8	4.2	3.4	5.1	0.9	1.8	0.6	1.3	5.9
Chromium	50	97	92	44	27	260	26	23	120
Copper	160	1600	110	230	46	76	29	40	100
Lead	77	560	460	550	51	67	37	53	180
Mercury	0.3	0.3	0.6	0.7	0.3	0.7	0.1	0.3	0.8
Nickel	19	56	51	34	12	31	16	20	35
Zinc	230	1100	540	530	270	230	230	210	540
Silver	0.3	1.6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	3.7
Boron	<8.0	12	12	11	8	15	<8	<8	8.5
Barium	52	150	120	110	34	120	52	49	130
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	5.5	6.4	6.4	8.7	4.2	7.4	5.7	5.8	7.2
Lithium	12	8.7	14	12	7	10	7	9.2	16
Manganese	290	730	570	450	180	5500	670	420	480
Molybdenum	<1.0	1.4	1.8	4.4	1.3	7.7	<1.0	<1.0	<1.0
Tin	4.0	15	7.2	19	7	15	6.7	7.4	59
Strontium	28	81	85	74	29	140	24	33	59
Vanadium	13	10	23	17	9	50	13	12	18
Yttrium	6.1	6.3	8	6.7	4.7	6.6	5.7	6.1	8.9
(All values below are g/kg dry weight)									
Calcium	19	67	49	15	14	76	13	18	29
Potassium	0.8	0.44	1.10	0.8	0.51	0.49	0.49	0.53	1.1
Magnesium	5.5	11	11	2.7	4.2	9.5	3.7	5.7	9
Sodium	0.2	0.21	0.36	0.2	<0.1	0.19	<0.1	<0.1	0.22
Aluminum	5.5	5.6	7.6	9.1	3.8	91	4.2	4.0	9
Iron	15	18	18	34	11	67	43	27	22

Table 4 (Cont.)

Parameter	Sampling Site								
	80A	81	82	86	87	87A	89	89A	90
Cadmium	0.22	2.1	2.3	1.9	6.0	4.20	0.60	<0.20	1.00
Chromium	18	44	100	44	89	74	9	7	25
Copper	31	72	390	71	170	140	10	10	37
Lead	2100	90	310	130	250	180	19	15	49
Mercury	0.2	0.8	1.1	0.6	0.5	1.2	0.2	0.1	0.3
Nickel	18	23	32	22	35	26	5.7	10	13.0
Zinc	120	430	630	420	770	780	120	54	190
Silver	<0.3	0.67	1.7	0.4	1.2	<0.3	<0.3	<0.3	<0.3
Boron	<8.0	<8	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
Barium	75	85	100	80	170	110	11	16	11
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	8	8	6.7	7.5	8.1	8	2.7	5	5.1
Lithium	20	19	17	14	14	17	3.7	10	1.2
Manganese	390	370	380	440	430	540	85	130	240
Molybdenum	1.2	1.0	2.4	1.2	3.5	2.7	<1.0	<1.0	1.6
Tin	25	5.4	32	10	24	17	<4.0	<4.0	<4.0
Strontium	120	56	66	43	59	43	13	17	30
Vanadium	18	17	17	13	17	18	5	9	9.3
Yttrium	8.9	9.8	8.4	7.3	8	9	4.7	6	6.6
(All values below are g/kg dry weight)									
Calcium	50	25	34	26	34	23	11	13	11
Potassium	1.7	1.3	1.1	0.82	0.94	1.2	0.21	0.7	0.21
Magnesium	15	10	12	7.3	9.2	7	4	7	4
Sodium	0.18	0.13	0.15	0.11	0.15	0.12	0.05	<0.1	0.05
Aluminum	9.0	9.4	8.1	6.4	8.0	8	1.7	4	1.7
Iron	16	19	19	24	25	36	4.5	9	4.5

Table 4 (Cont.)

Parameter	Sampling Site								
	91A	91B	91C	92	95				
Cadmium	<0.20	<0.20	<0.20	2.00	0.35				
Chromium	12	22	8	53	11				
Copper	12	18	13	68	10				
Lead	32	22	15	190	100				
Mercury	0.1	0.1	0.1	1.4	0.3				
Nickel	14	27	11	25.0	3.8				
Zinc	63	65	58	480	120				
Silver	<0.3	<0.3	<0.3	0.37	<0.3				
Boron	<8.0	9.2	<8.0	<8.0	12				
Barium	28	120	25	84	9.8				
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1				
Cobalt	6	13	5.5	7.7	1.5				
Lithium	14	33	11	17	6.6				
Manganese	310	610	150	300	490				
Molybdenum	1.1	<1.0	1.2	1.8	2.9				
Tin	<4	<4	<4.0	7	13				
Strontium	31	99	21	48	64				
Yttrium	8	14	6.4	7.8	2.9				
Vanadium	9	25	8	16	4.0				
(All values below are g/kg dry weight)									
Calcium	35	48	15	30	84				
Potassium	0.8	3	0.8	1.10	0.24				
Magnesium	17	14	7	12	17				
Sodium	<0.1	0.18	<0.10	0.12	0.13				
Aluminum	5	16	4.6	8.2	1.2				
Iron	14	24	9	17	7.8				

Table 5

Concentrations of Conventional Pollutants in Sediments of the Buffalo and Niagara Rivers, New York, 1981

(All values are mg/kg dry weight)

Parameter	Sampling Site						
	01	02	03	04	05	07	08
% Total Solids	30.6	61	67.7	59.6	53.1	58.7	68.1
% Total Volatile Solids	12.0	5.3	3.1	3.5	5.5	4.7	4.4
Total Kjeldahl Nitrogen	3,400	1,900	640	1,100	1,600	1,700	1,100
Total Phosphorus	1,300	700	390	500	660	550	560
Chemical Oxygen Demand	120,000	46,000	29,000	29,000	73,000	51,000	45,000
Phenols	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Cyanide	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2

Parameter	Sampling Site						
	10	11	12	12	12	12	13
						Bottom	
% Total Solids	64.8	60.8	66.9	53.6	43.5	50.6	51.2
% Total Volatile Solids	6.0	5.2	8.6	16.8	5.7	5.7	4.7
Total Kjeldahl Nitrogen	1,600	1,400	1,000	4,700	1,700	2,400	1,400
Total Phosphorus	670	710	580	960	760	840	640
Chemical Oxygen Demand	71,000	48,000	110,000	210,000	80,000	110,000	55,000
Phenols	<0.6	<0.6	1.1	350	1.5	2.4	<0.6
Cyanide	<1.2	<1.2	2.7	8.4	<1.2	2.0	<1.2

Parameter	Sampling Site						
	16	19	22	24	26	27	31
% Total Solids	53.6	65.7	60.3	58.4	53.5	55.4	43.5
% Total Volatile Solids	5.1	3.6	5.1	5.1	8.9	5.6	11.7
Total Kjeldahl Nitrogen	1,600	1,000	1,200	1,400	1,700	1,700	3,200
Total Phosphorus	590	610	590	600	990	740	1,800
Chemical Oxygen Demand	59,000	41,000	61,000	63,000	120,000	67,000	140,000
Phenols	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Cyanide	<1.2	3.5	1.9	1.6	1.5	1.3	2.0

Table 5 (Cont.)

Parameter	Sampling Site						
	32	33	35	37	40	41	43
% Total Solids	31.8	36.2	47.5	46.6	50.5	50.3	46.5
% Total Volatile Solids	14.0	11.0	8.3	10.4	8.3	9.0	8.8
Total Kjeldahl Nitrogen	3,200	2,900	2,700	3,000	2,800	3,000	2,800
Total Phosphorus	1,900	1,700	1,100	3,900	1,500	1,800	1,300
Chemical Oxygen Demand	220,000	160,000	92,000	150,000	100,000	120,000	110,000
Phenols	<0.6	<0.6	3.3	<0.6	<0.6	<0.6	0.7
Cyanide	1.7	<1.2	3.7	<1.2	1.2	2.1	4.3

Parameter	Sampling Site						
	44	45	48	51	52	53	54
% Total Solids	53.2	40.0	61.5	59.9	48.3	51.9	53.8
% Total Volatile Solids	4.8	7.5	4.9	5.3	7.4	5.6	6.2
Total Kjeldahl Nitrogen	1,100	2,100	1,200	1,800	2,300	2,000	2,100
Total Phosphorus	640	810	560	740	1,200	820	850
Chemical Oxygen Demand	54,000	60,000	46,000	57,000	78,000	64,000	63,000
Phenols	<0.6	1.5	<0.6	<0.6	<0.6	<0.6	<0.6
Cyanide	1.7	2.1	<1.2	1.7	1.6	1.4	<1.2

Parameter	Sampling Site						
	55	56	57	58	59	60	61
% Total Solids	56.1	54.7	60.0	42.8	49.6	56.2	62.1
% Total Volatile Solids	7.7	7.1	5.7	10.6	11.0	7.3	3.0
Total Kjeldahl Nitrogen	1,500	1,400	310	2,200	1,900	1,300	510
Total Phosphorus	670	660	330	800	1,100	650	490
Chemical Oxygen Demand	60,000	74,000	35,000	120,000	120,000	83,000	37,000
Phenols	<0.6	<0.6	1.2	0.7	<0.6	<0.6	<0.6
Cyanide	3.6	3.0	75	84	35	2.5	<1.2

Table 5 (Cont.)

Parameter	Sampling Site						
	65	66	67	70	71	72	73
% Total Solids	47.7	40.4	54.5	59.4	75.2	31.0	71.6
% Total Volatile Solids	5.4	7.2	4.8	3.8	2.0	25.4	3.1
Total Kjeldahl Nitrogen	1,800	2,100	1,800	850	360	4,500	480
Total Phosphorus	680	690	1,200	620	1,300	1,900	470
Chemical Oxygen Demand	64,000	81,000	75,000	29,000	20,000	310,000	34,000
Phenols	<0.6	0.8	<0.6	<0.6	<0.6	11	1.6
Cyanide	2.0	<1.2	6.0	2.8	2.9	2.5	<1.2

Parameter	Sampling Site						
	74A	74B	75	76	78	80A	81
% Total Solids	77.9	45.2	71.7	65.8	58.3	68.1	45.1
% Total Volatile Solids	2.8	4.3	3.3	4.0	7.4	3.1	5.5
Total Kjeldahl Nitrogen	250	380	270	320	1,300	360	1,500
Total Phosphorus	390	1,400	510	450	1,300	420	1,000
Chemical Oxygen Demand	31,000	32,000	15,000	24,000	89,000	27,000	66,000
Phenols	0.6	0.4	<0.6	<0.6	<0.6	0.6	<0.6
Cyanide	<1.2	7.3	2.0	1.6	2.9	<1.2	5.9

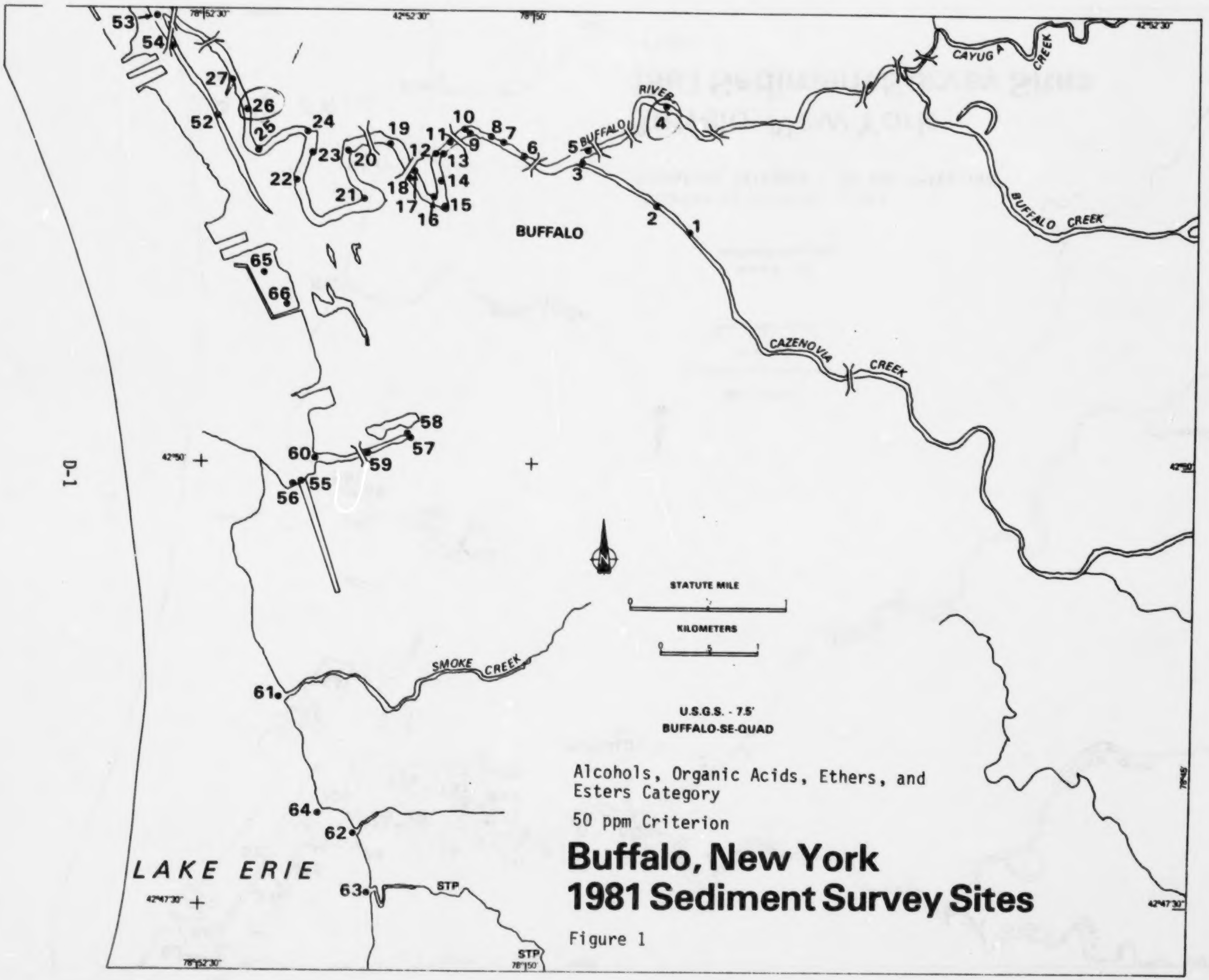
Parameter	Sampling Site						
	82	83	86	87	87A	89	89A
% Total Solids	64.1	69.3	63.1	61.1	69.3	71.7	40.2
% Total Volatile Solids	8.3	4.1	4.6	7.6	8.6	0.7	2.1
Total Kjeldahl Nitrogen	1,700	760	1,300	1,600	980	200	310
Total Phosphorus	1,500	930	1,400	1,500	870	440	450
Chemical Oxygen Demand	89,000	51,000	54,000	75,000	77,000	7,600	24,000
Phenols	30	0.7	<0.6	0.9	0.6	<0.6	1.4
Cyanide	2.1	2.8	2.1	4.4	3.9	<1.2	<1.2

Table 5 (Cont.)

Parameter	Sampling Site						
	90	91A	91B	91C	92	95	
% Total Solids	71.7	75.5	51.4	60.7	37.9	38.6	
% Total Volatile Solids	2.5	2.1	2.6	1.6	9.9	1.6	
Total Kjeldahl Nitrogen	580	300	530	270	3,300	170	
Total Phosphorus	770	470	1,100	490	1,300	260	
Chemical Oxygen Demand	28,000	23,000	23,000	17,000	140,000	12,000	
Phenols	<0.6	0.6	0.8	0.6	0.9	<0.6	
Cyanide	<1.2	<1.2	<1.2	2.1	2.2	3.2	

APPENDIX D

Maps of Sites Where at Least One Organic Parameter in a Category Exceeded the 50 ppm Concentration Levels or One Conventional or Metal Parameter Was Classified as Heavily Polluted by USEPA Guidelines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BUFFALO
RIVER
BUFFALO
CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
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57
59
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SMOKE CREEK
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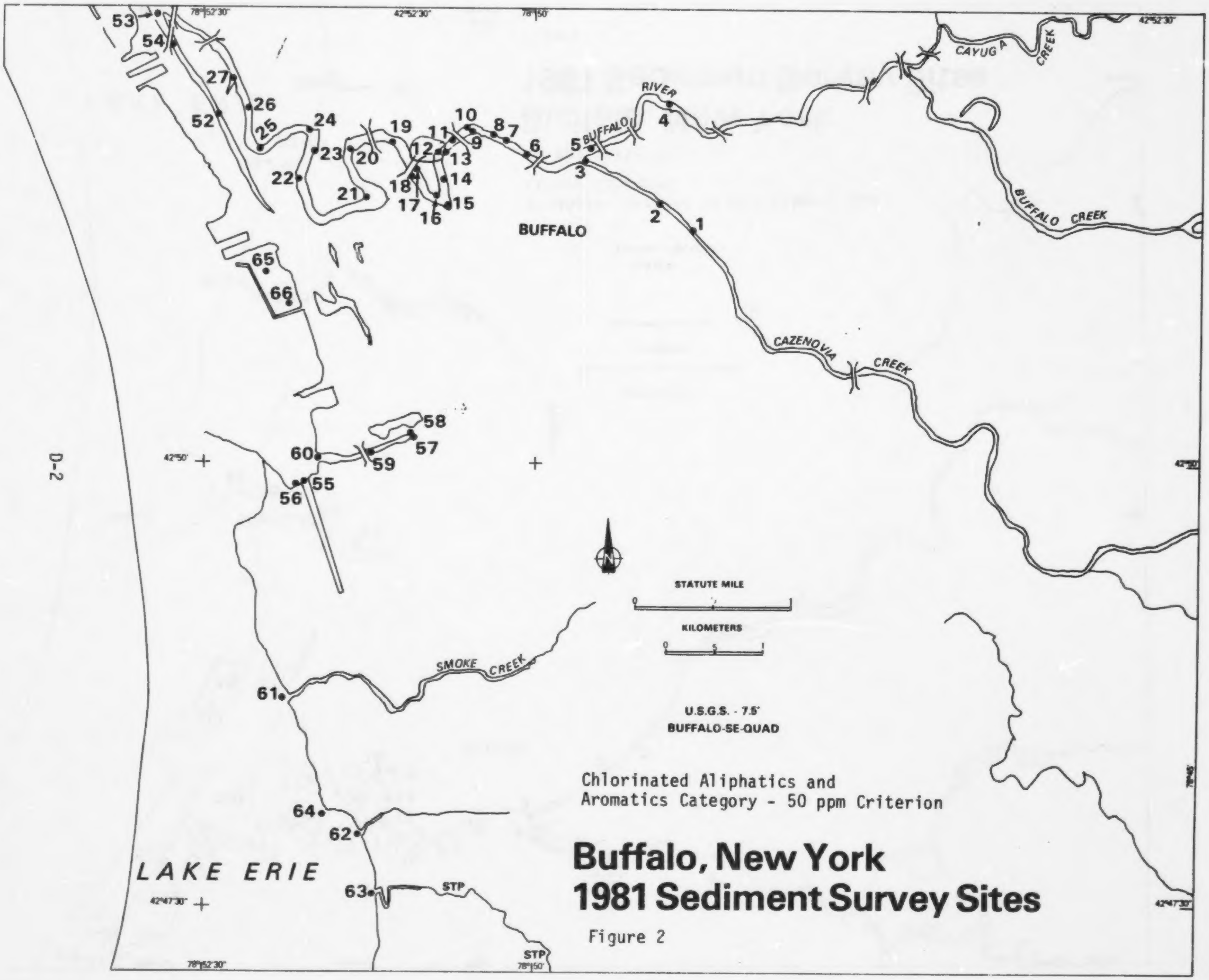
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD

Alcohols, Organic Acids, Ethers, and Esters Category

50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 1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RIVER
BUFFALO
CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
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78°52'30"
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42°47'30"
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KILOMETERS
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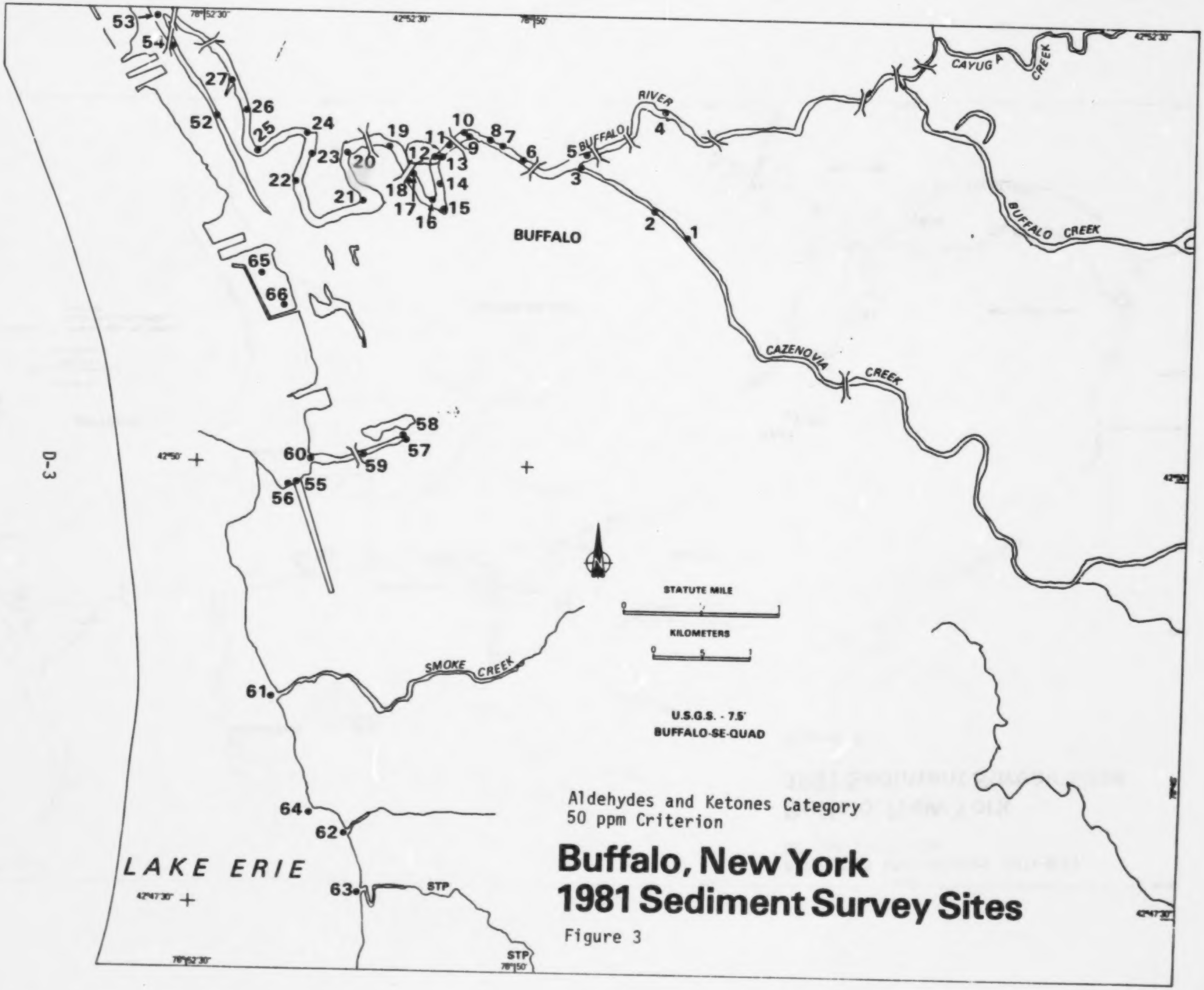
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD

Chlorinated Aliphatics and
Aromatics Category - 50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 2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19
22
21
18
17
16
15
14
13
12
11
10
9
8
7
6
5
3
2
1
4
BUFFALO
RIVER
BUFFALO
CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
65
66
58
57
59
60
55
56
SMOKE CREEK
61
64
62
63
STP
STP
LAKE ERIE
STATUTE MILE
0
1
KILOMETERS
0
.5
1
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
78°52'30"
42°52'30"
78°50'
42°50'
42°47'30"

Aldehydes and Ketones Category
50 ppm Criterion

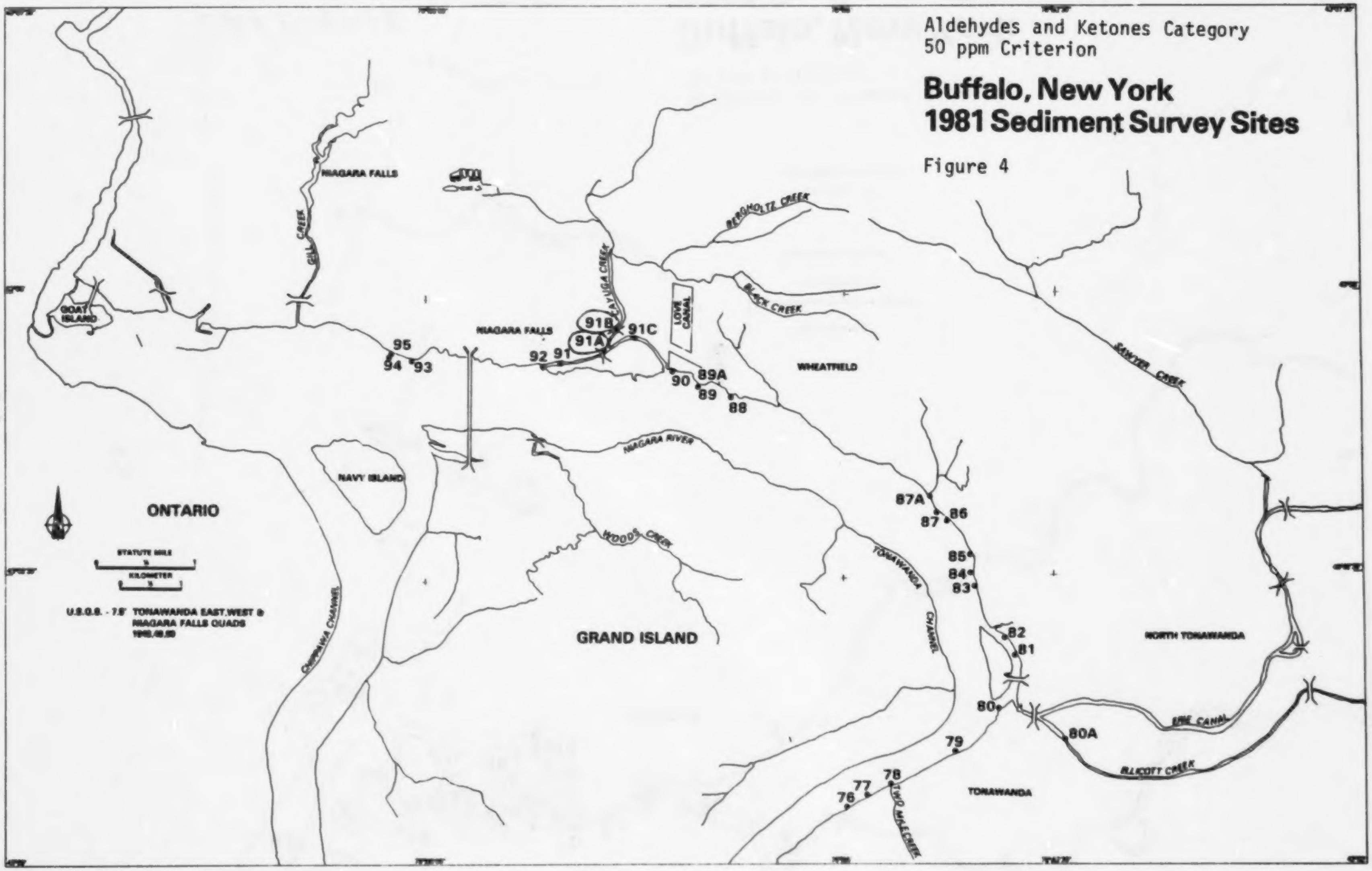
Buffalo, New York
1981 Sediment Survey Sites

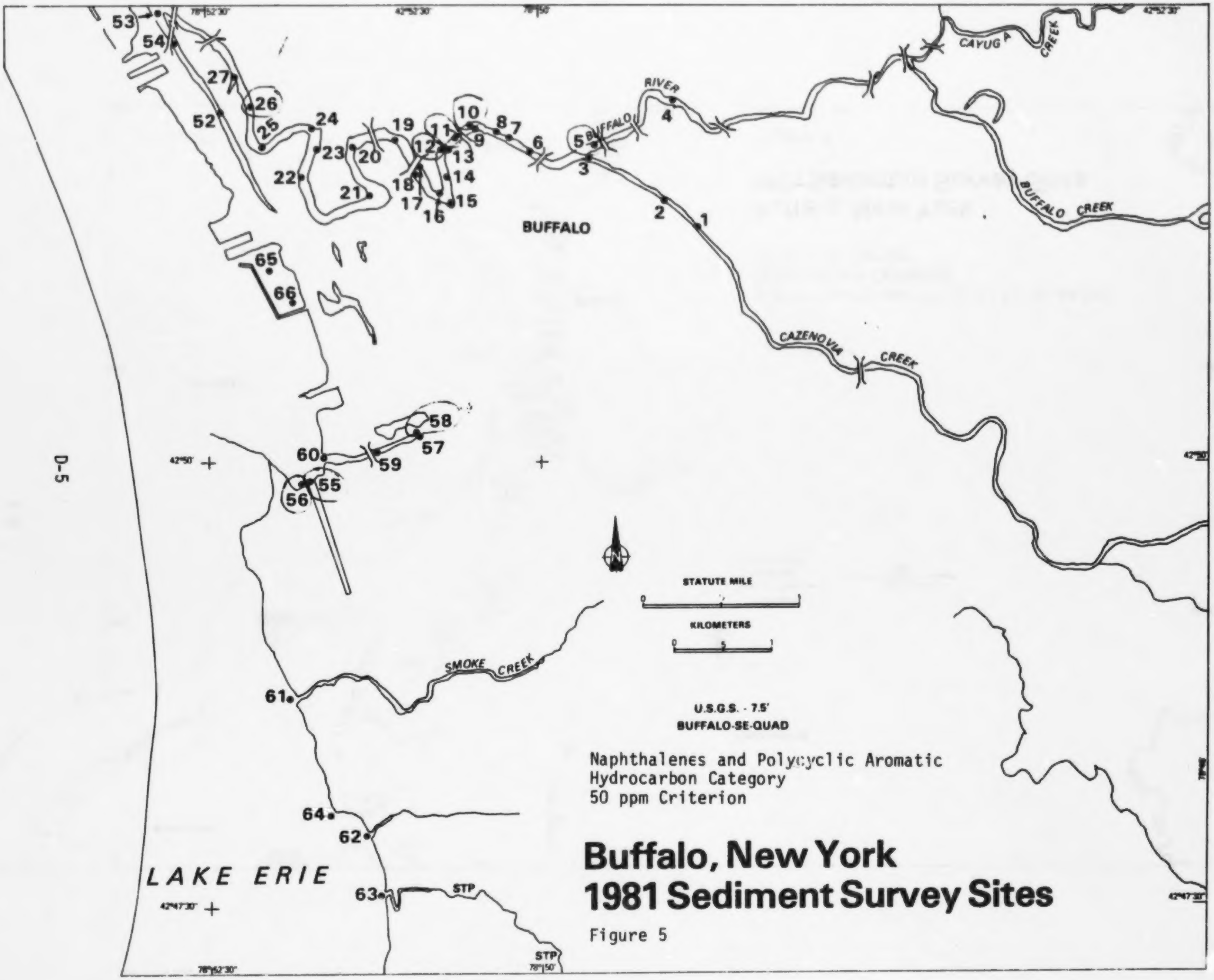
Figure 3

Aldehydes and Ketones Category
50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 4


NIAGARA FALLS
GILL CREEK
GOAT ISLAND
95
94
93
NIAGARA FALLS
92
91
91A
91B
91C
CAYUGA CREEK
LOVE CANAL
90
89A
89
88
BERGHOLTZ CREEK
BLACK CREEK
WHEATFIELD
SAWYER CREEK
NIAGARA RIVER
NAVY ISLAND
ONTARIO
STATUTE MILE
KILOMETER
U.S.G.S. - 7.5' TONAWANDA EAST, WEST &
NIAGARA FALLS QUADS
CHIPPAWA CHANNEL
WOODS CREEK
GRAND ISLAND
TONAWANDA CHANNEL
87A
87
86
85
84
83
82
81
80
80A
79
78
77
76
TWO MILE CREEK
NORTH TONAWANDA
ERIE CANAL
ELLICOTT CREEK
TONAWANDA


78°52'30"
42°52'30"
78°50'
42°52'30"
CAYUGA CREEK
BUFFALO CREEK
BUFFALO RIVER
CAZENOVIA CREEK
SMOKE CREEK
BUFFALO
LAKE ERIE
STP
STP
42°50'
42°50'
42°47'30"
42°47'30"
78°52'30"
78°50'
N
STATUTE MILE
0
1
KILOMETERS
0
.5
1
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
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24
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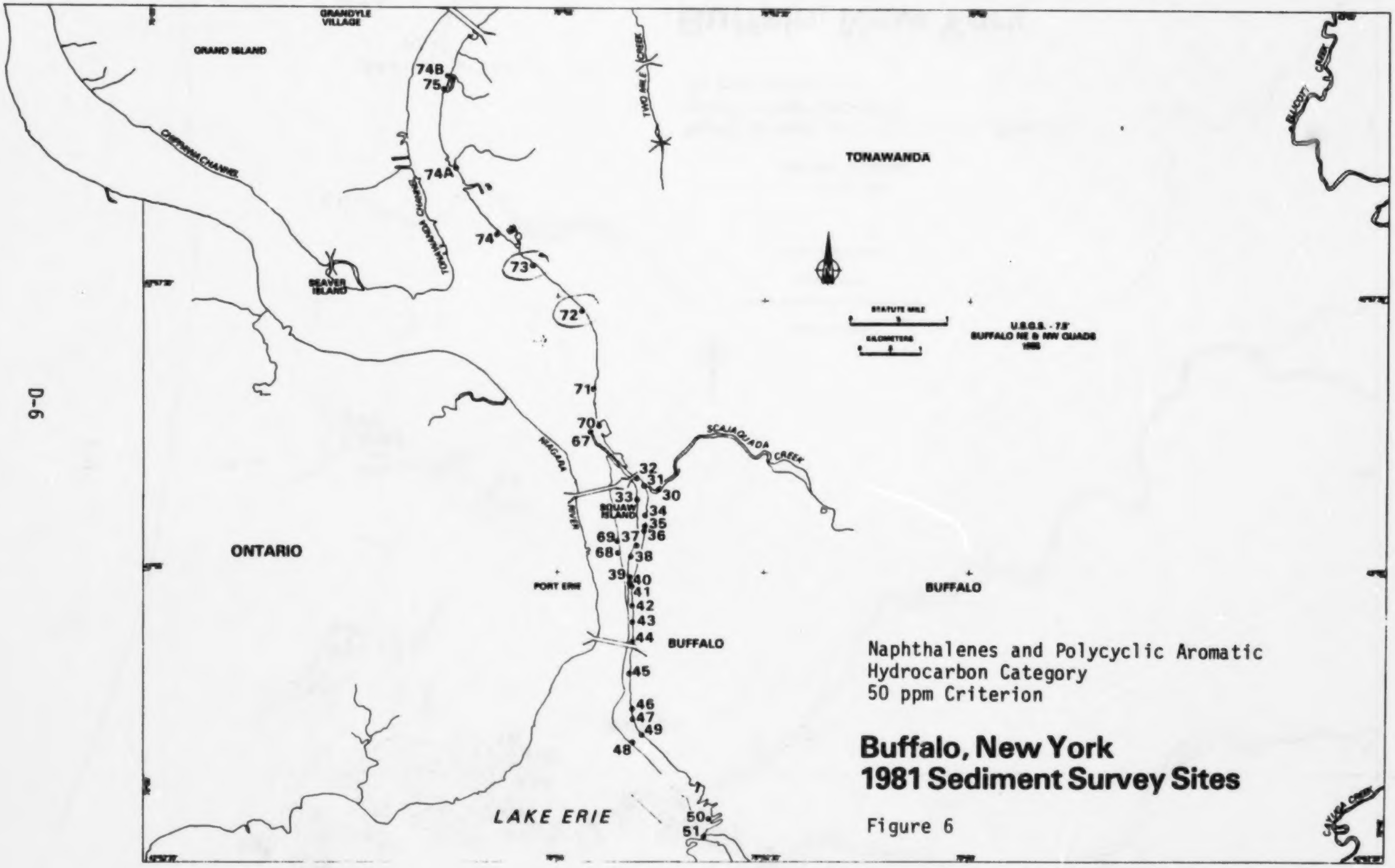
27
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66

Naphthalenes and Polycyclic Aromatic
Hydrocarbon Category
50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

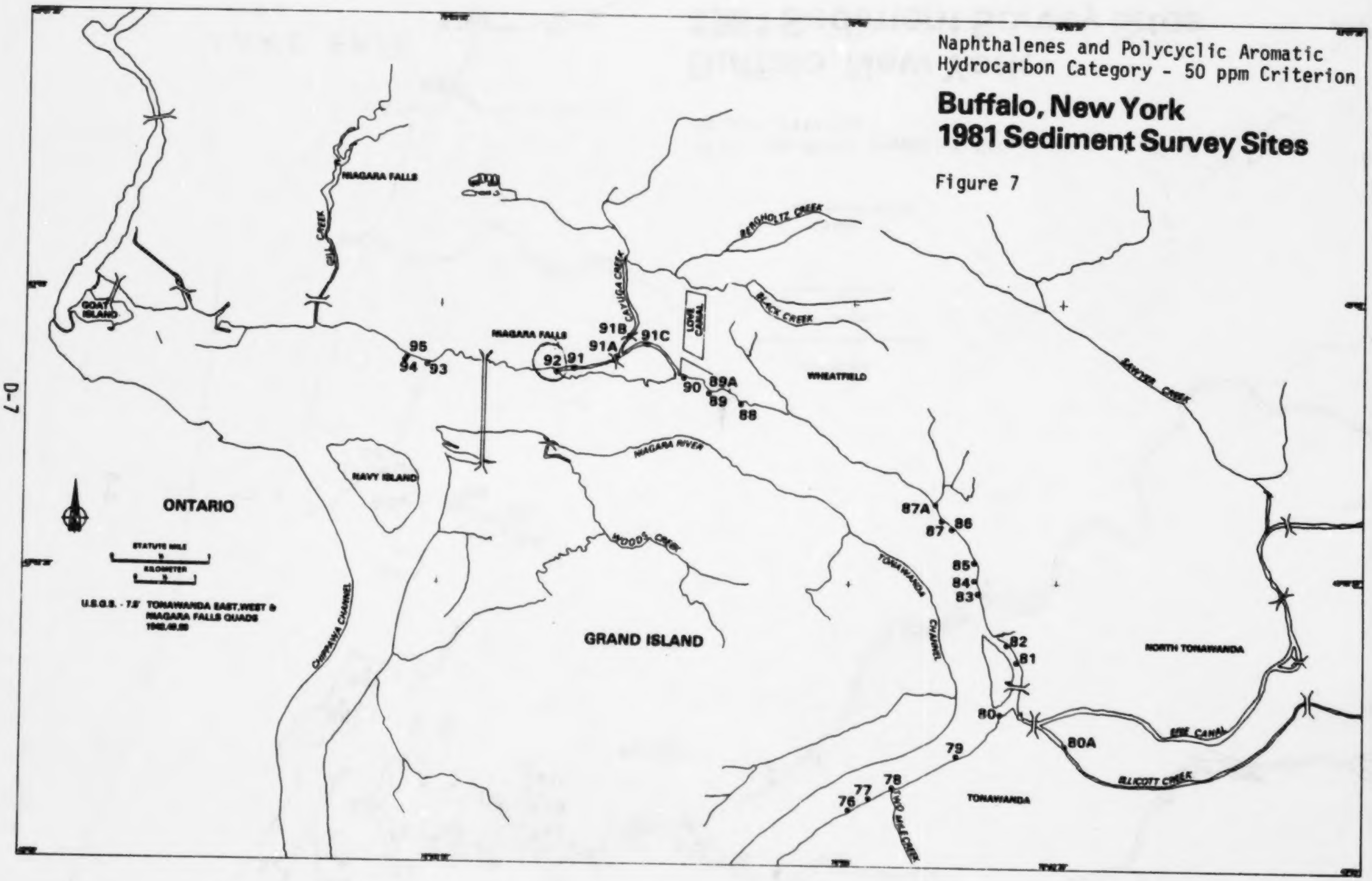
Figure 5


GRANDYLE VILLAGE
GRAND ISLAND
CHIPPAWA CHANNEL
BEAVER ISLAND
TONAWANDA CHANNEL
74B
75
74A
74
73
72
71
70
67
TWO MILE CREEK
TONAWANDA
ELLICOTT CREEK
N
STATUTE MILE
0
½
1
KILOMETERS
0
½
1
U.S.G.S. - 7.5'
BUFFALO NE & NW QUADS
SCAJAQUADA CREEK
NIAGARA RIVER
32
31
30
33
SQUAW ISLAND
34
35
36
69
37
68
38
39
40
41
42
43
44
45
46
47
49
48
50
51
ONTARIO
PORT ERIE
BUFFALO
BUFFALO
LAKE ERIE
CAYUGA CREEK

Naphthalenes and Polycyclic Aromatic
Hydrocarbon Category
50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 6

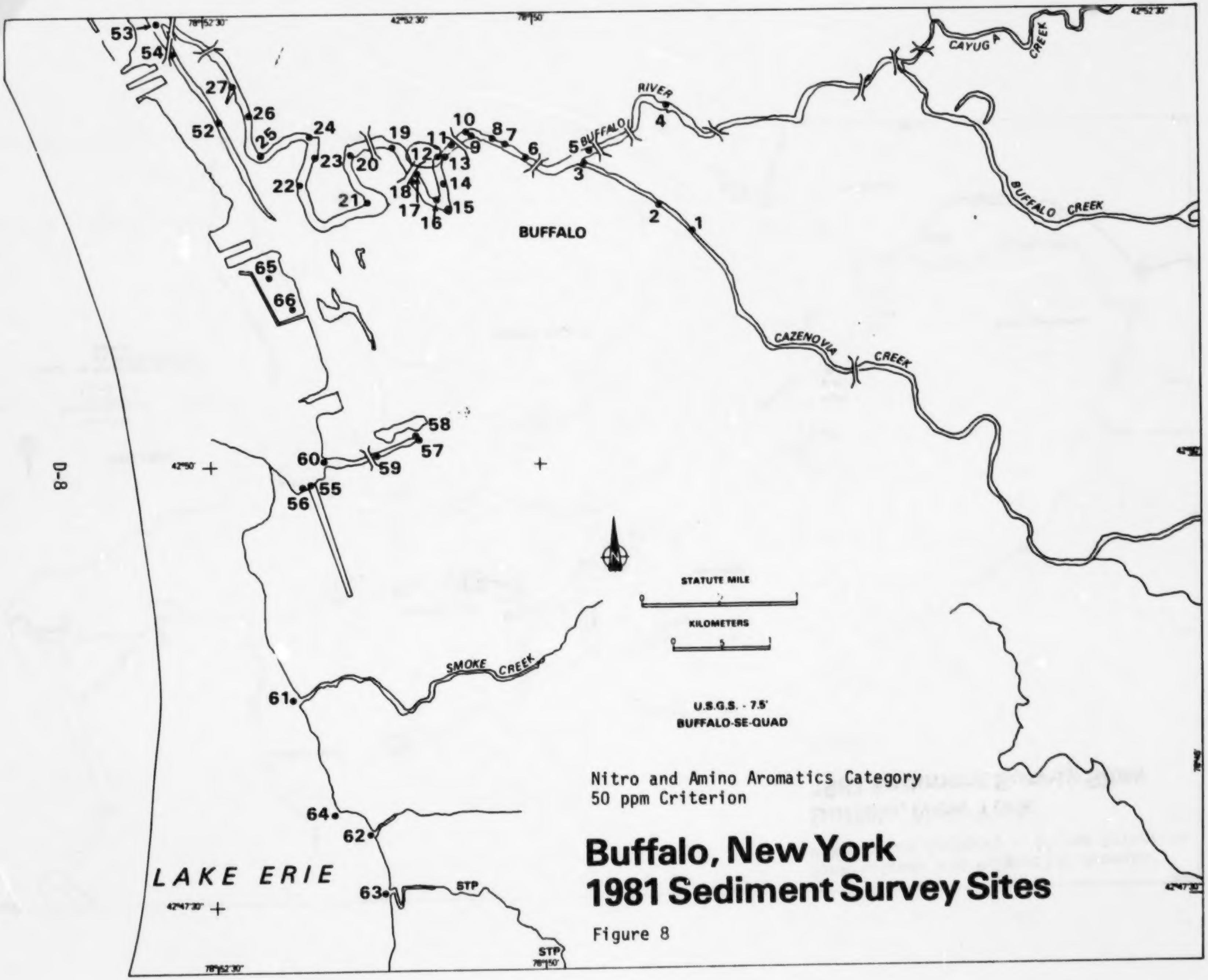


Naphthalenes and Polycyclic Aromatic Hydrocarbon Category - 50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 7

GOAT ISLAND
NIAGARA FALLS
GILL CREEK
NIAGARA FALLS
95
94
93
92
91
91A
91B
91C
CAYUGA CREEK
LOVE CANAL
BERGHOLTZ CREEK
BLACK CREEK
WHEATFIELD
90
89A
89
88
SAWYER CREEK
NAVY ISLAND
ONTARIO
NIAGARA RIVER
WOODS CREEK
GRAND ISLAND
CHIPPAWA CHANNEL
TONAWANDA CHANNEL
87A
87
86
85
84
83
82
81
80
80A
79
78
77
76
TWO MILE CREEK
NORTH TONAWANDA
TONAWANDA
ERIE CANAL
ELLICOTT CREEK
STATUTE MILE
KILOMETER
U.S.G.S. - 7.5' TONAWANDA EAST, WEST & NIAGARA FALLS QUADS


LAKE ERIE
BUFFALO
BUFFALO RIVER
CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
SMOKE CREEK
STP
STP
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
78°52'30"
42°52'30"
78°50'
42°50'
42°47'30"
1
2
3
4
5
6
7
8
9
10
11
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14
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16
17
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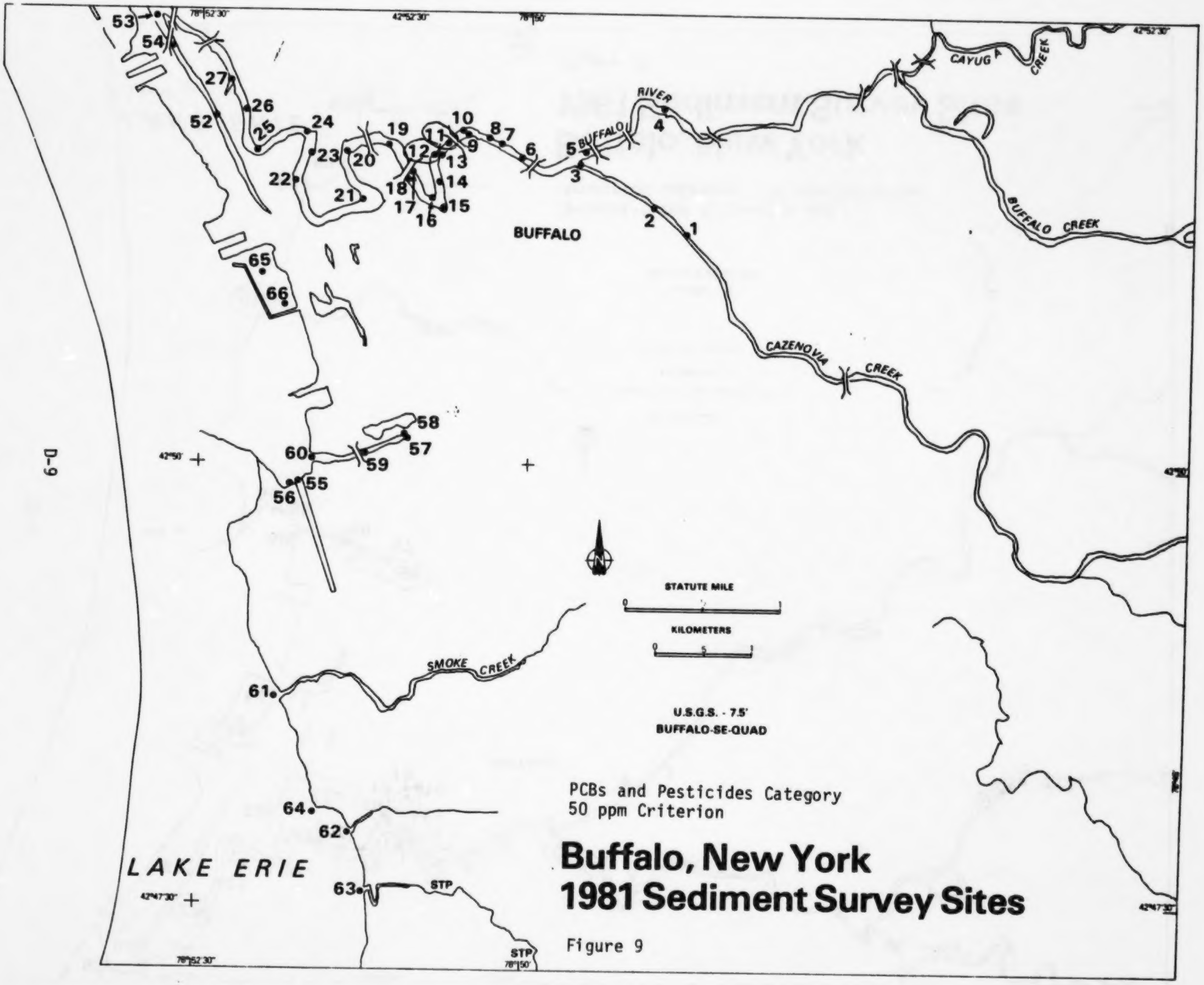
63
64
65
66

Nitro and Amino Aromatics Category
50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 8


53
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22
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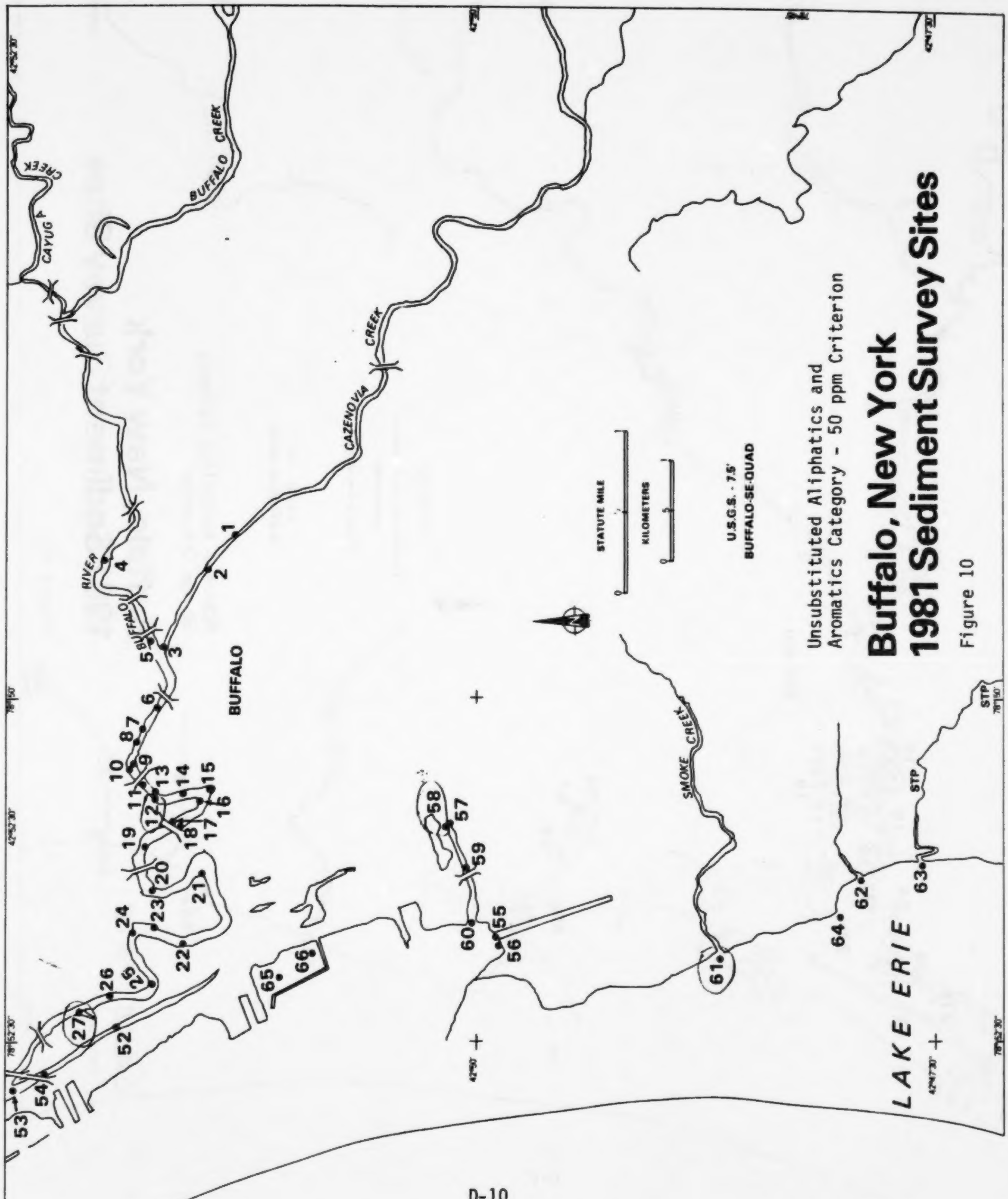
21
19
18
17
16
12
11
10
9
8
7
6
5
4
3
2
1
13
14
15
65
66
58
57
59
60
55
56
61
64
62
63
STP
STP
BUFFALO
BUFFALO RIVER
CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
SMOKE CREEK
LAKE ERIE
STATUTE MILE
0
1
KILOMETERS
0
.5
1
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
78°52'30"
42°52'30"
78°50'
42°50'
42°47'30"

PCBs and Pesticides Category
50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

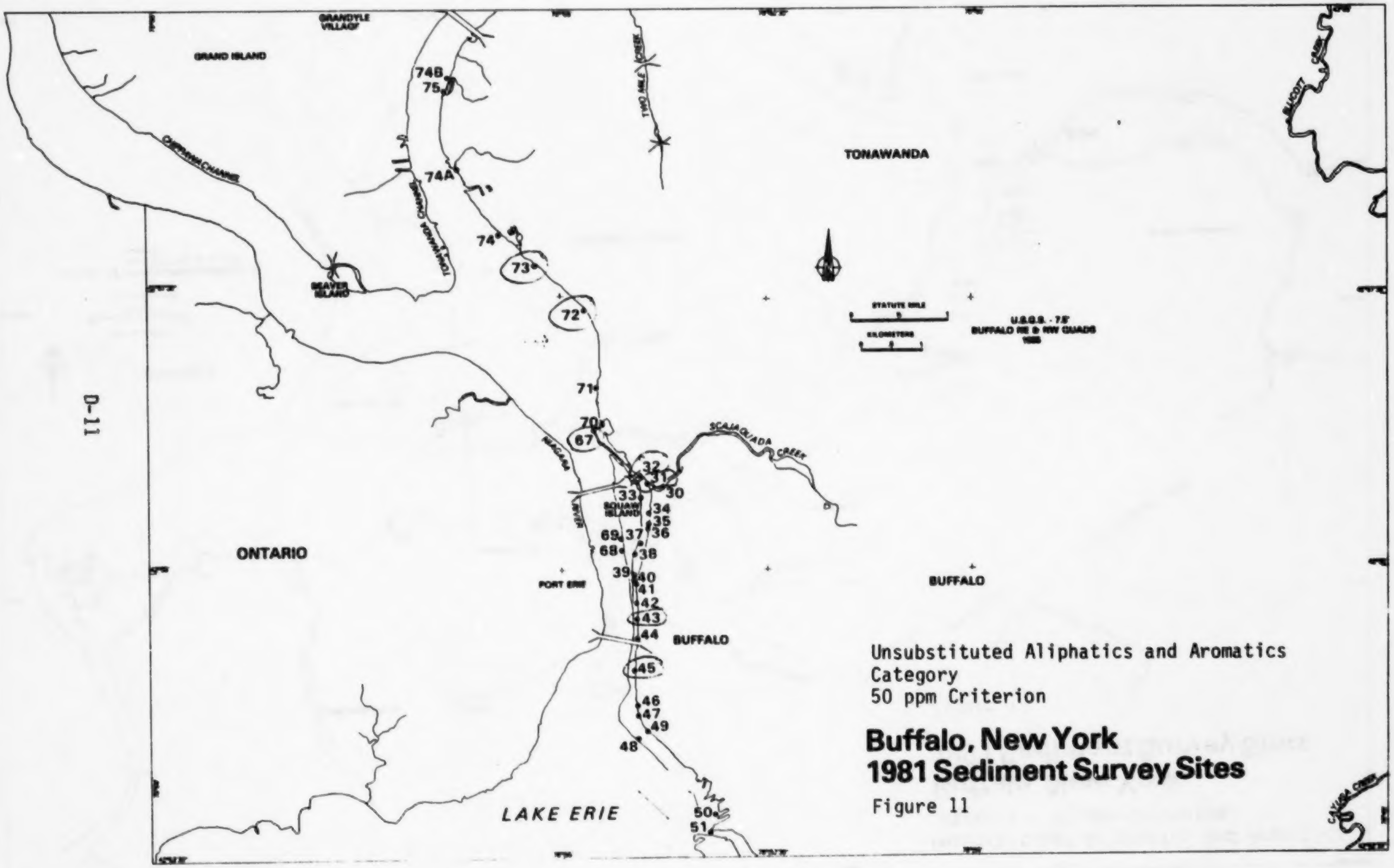
Figure 9


BUFFALO RIVER
BUFFALO CREEK
CAYUGA CREEK
CAZENOVIA CREEK
SMOKE CREEK
BUFFALO
LAKE ERIE
STP
STP
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
42°52'30"
78°50'
42°50'
42°47'30"
78°52'30"
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66

Unsubstituted Aliphatics and Aromatics Category - 50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 10


GRANDYLE VILLAGE
GRAND ISLAND
CHIPPAWA CHANNEL
BEAVER ISLAND
TONAWANDA CHANNEL
TWO MILE CREEK
TONAWANDA
ELLICOTT CREEK
74B
75
74A
74
73
72
71
70
67
32
31
30
33
SQUAW ISLAND
34
35
36
69
37
68
38
39
40
41
42
43
44
45
46
47
49
48
50
51
NIAGARA RIVER
SCAJAQUADA CREEK
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO NE & NW QUADS
ONTARIO
PORT ERIE
BUFFALO
BUFFALO
LAKE ERIE
CAYUGA CREEK

Unsubstituted Aliphatics and Aromatics
Category
50 ppm Criterion

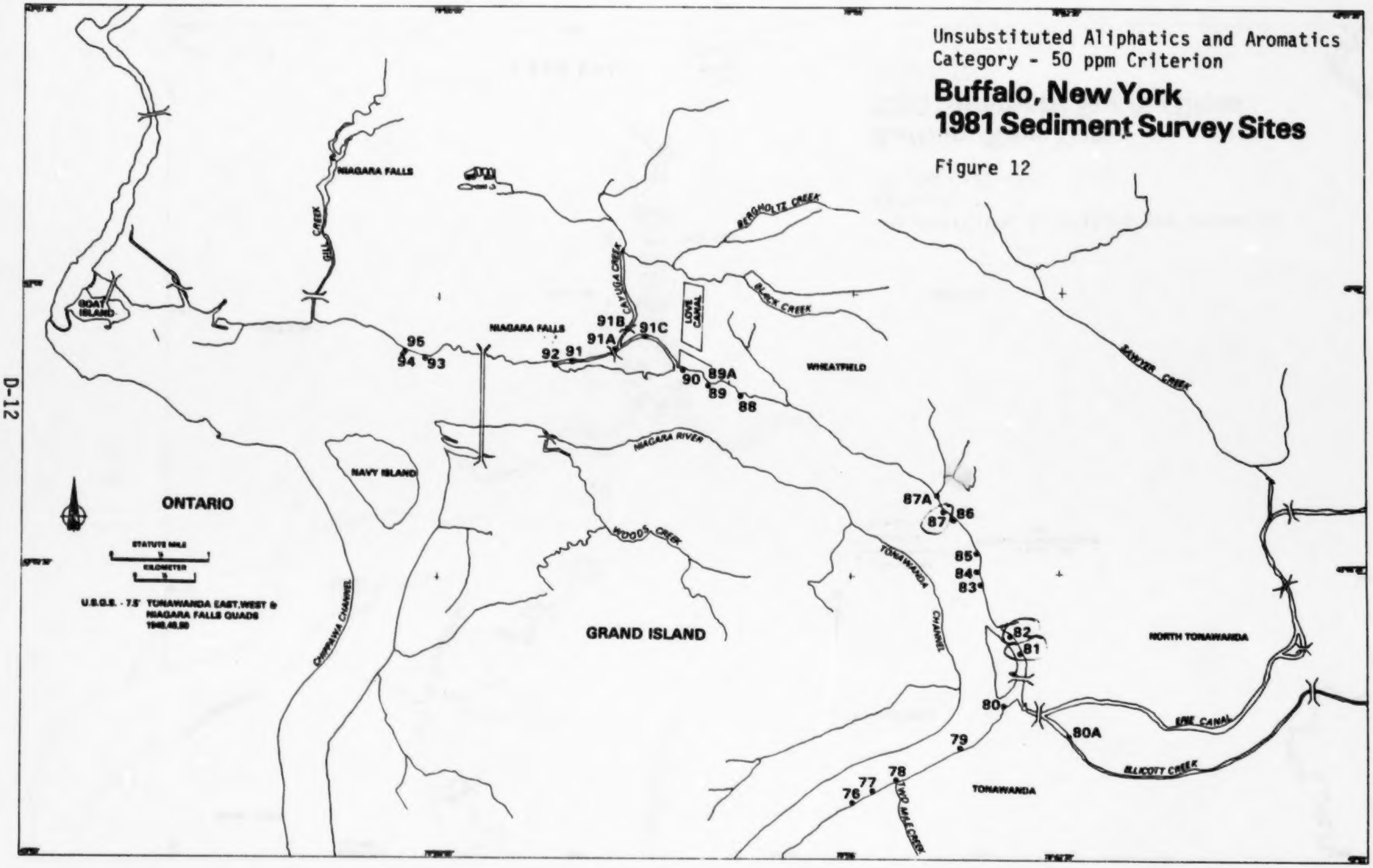
Buffalo, New York
1981 Sediment Survey Sites

Figure 11

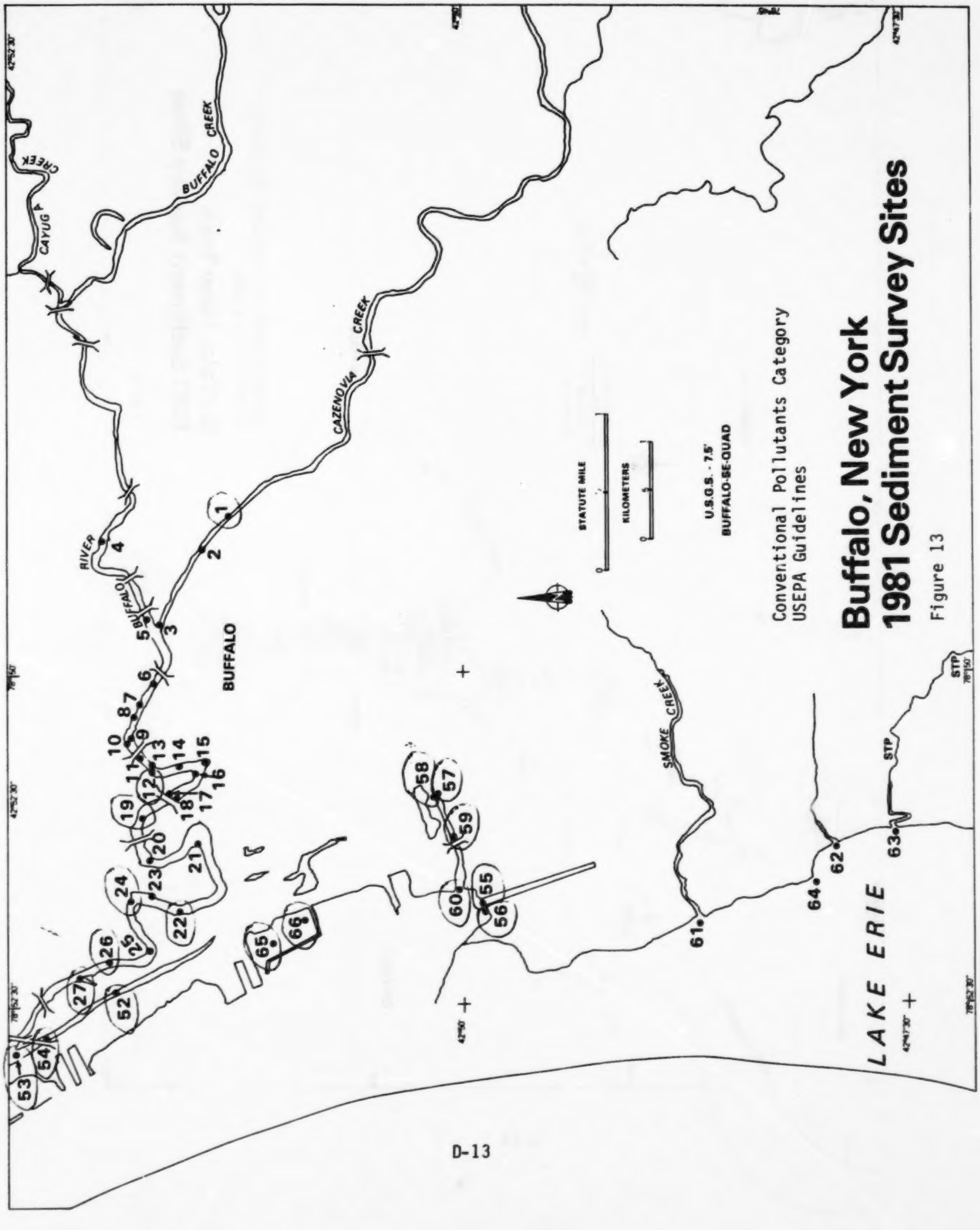
Unsubstituted Aliphatics and Aromatics
Category - 50 ppm Criterion

Buffalo, New York
1981 Sediment Survey Sites

Figure 12


NIAGARA FALLS
GILL CREEK
BOAT ISLAND
95
94
93
NIAGARA FALLS
92
91
91A
91B
91C
CAYUGA CREEK
LOVE CANAL
90
89A
89
88
BERGHOLTZ CREEK
BLACK CREEK
WHEATFIELD
SAWYER CREEK
NIAGARA RIVER
NAVY ISLAND
ONTARIO
STATUTE MILE
KILOMETER
WOODS CREEK
GRAND ISLAND
CHIPPAWA CHANNEL
TONAWANDA CHANNEL
87A
87
86
85
84
83
82
81
NORTH TONAWANDA
80
80A
ERIE CANAL
ELLICOTT CREEK
79
78
77
76
TWO MILE CREEK
TONAWANDA

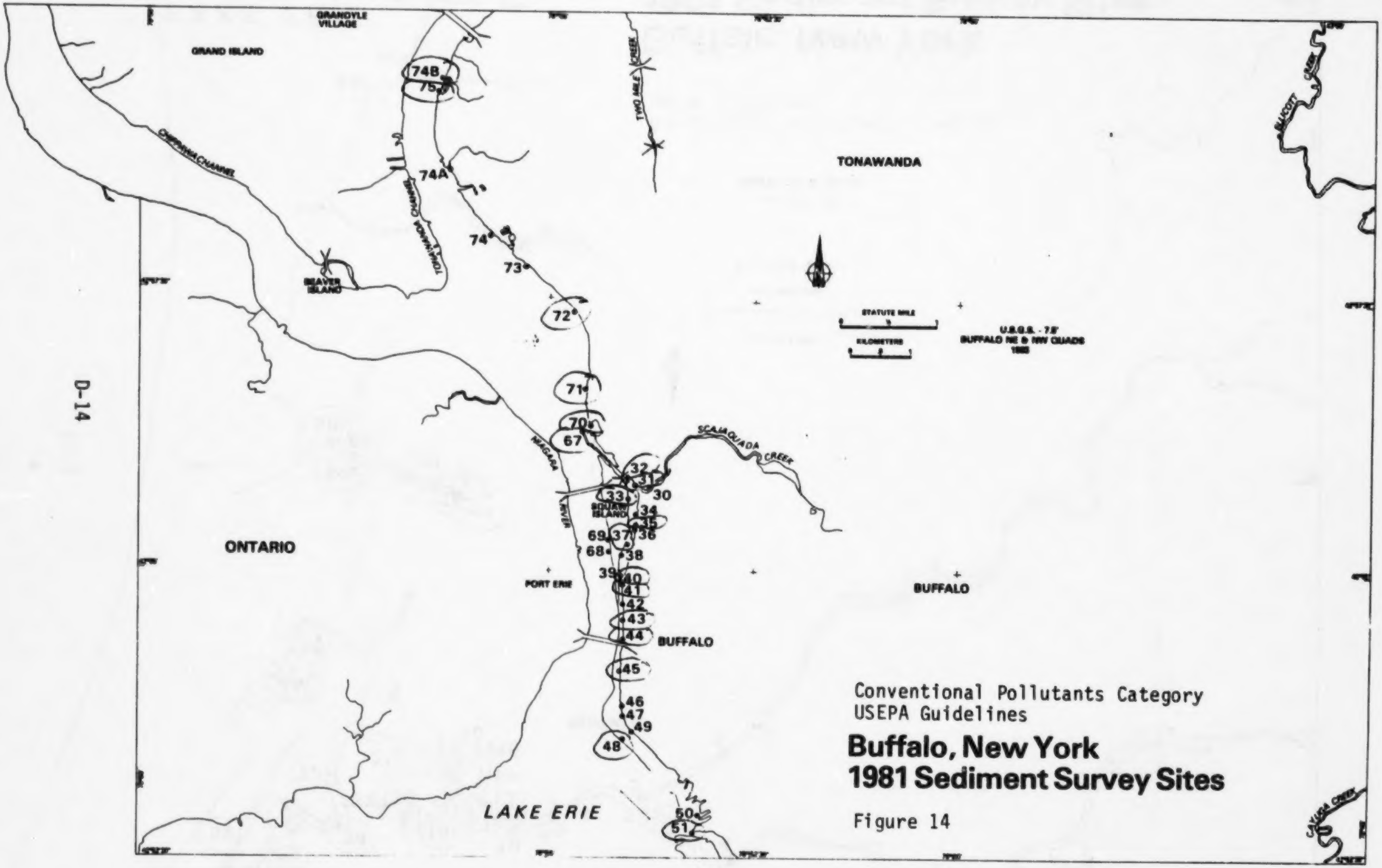
U.S.G.S. - 7.5' TONAWANDA EAST, WEST & NIAGARA FALLS QUADS 1948,49,50


CAYUGA CREEK
BUFFALO CREEK
BUFFALO RIVER
CAZENOVIA CREEK
BUFFALO
SMOKE CREEK
LAKE ERIE
STP
STP
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
42°52'30"
78°50'
78°52'30"
42°50'
42°47'30"
78°45'

Conventional Pollutants Category
USEPA Guidelines

Buffalo, New York
1981 Sediment Survey Sites

Figure 13


GRAND ISLAND
GRANDYLE VILLAGE
CHIPPAWA CHANNEL
BEAVER ISLAND
TONAWANDA CHANNEL
TWO MILE CREEK
TONAWANDA
ONTARIO
NIAGARA RIVER
PORT ERIE
SQUAW ISLAND
SCAJAQUADA CREEK
BUFFALO
BUFFALO
LAKE ERIE
ELLICOTT CREEK
CAYUGA CREEK
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO NE & NW QUADS
74B
75
74A
74
73
72
71
70
67
32
31
30
33
34
35
36
37
69
68
38
39
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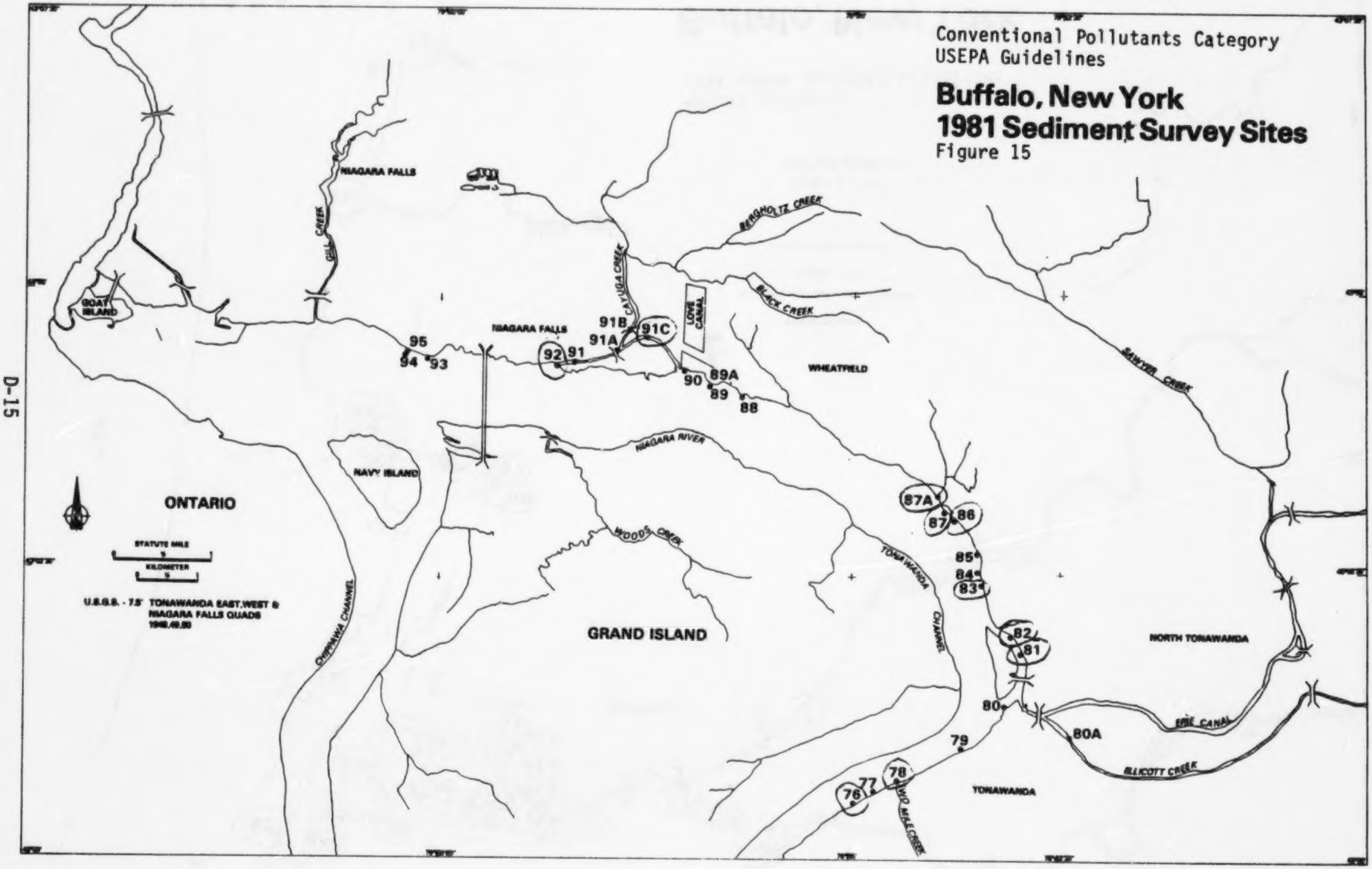
41
42
43
44
45
46
47
49
48
50
51

Conventional Pollutants Category
USEPA Guidelines

Buffalo, New York
1981 Sediment Survey Sites

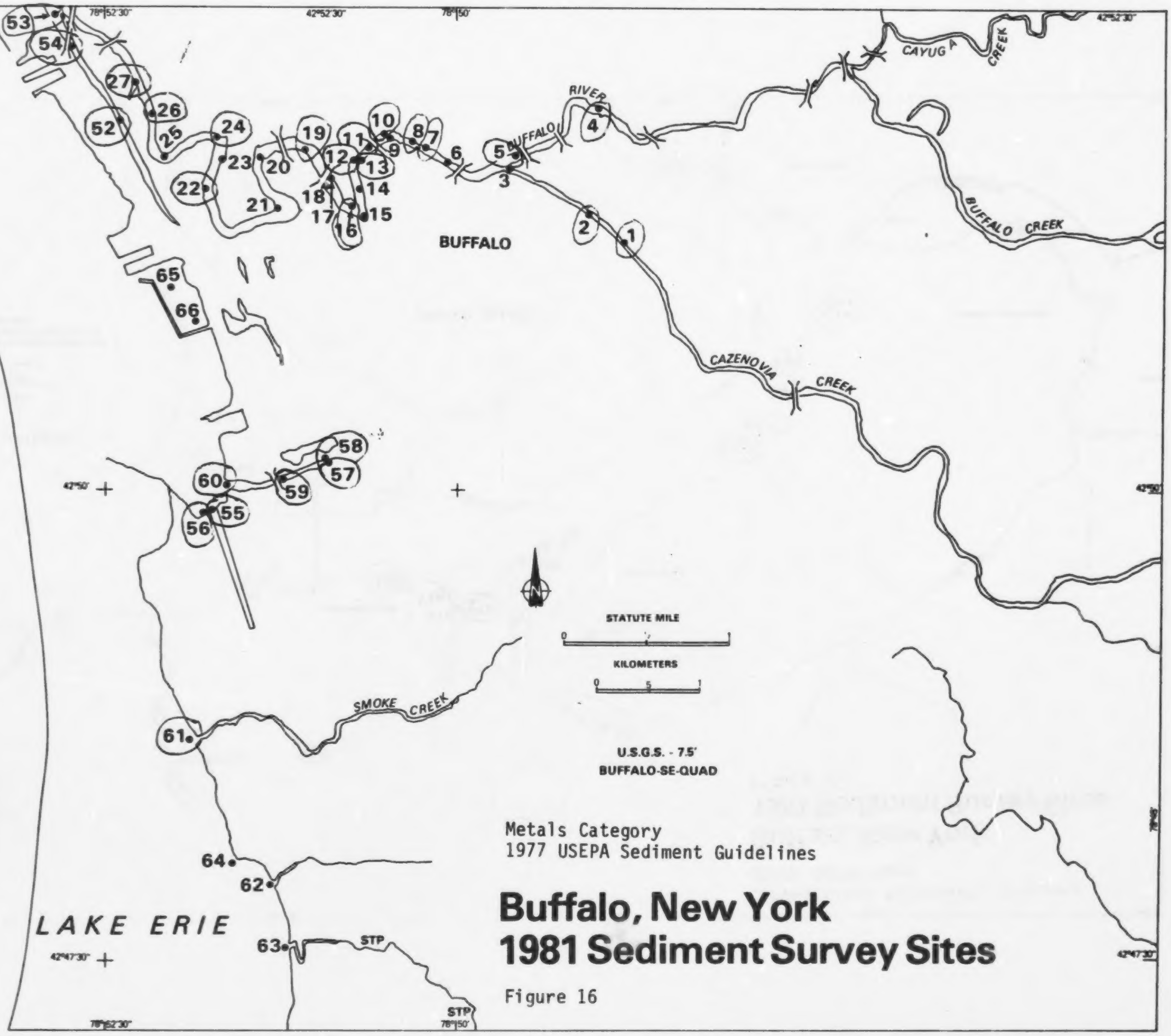
Figure 14



Conventional Pollutants Category
USEPA Guidelines

Buffalo, New York
1981 Sediment Survey Sites
Figure 15

NIAGARA FALLS
GILL CREEK
GOAT ISLAND
NIAGARA FALLS
CAYUGA CREEK
LOVE CANAL
BERGHOLTZ CREEK
BLACK CREEK
WHEATFIELD
SAWYER CREEK
95
94
93
92
91
91A
91B
91C
90
89A
89
88
87A
87
86
85
84
83
82
81
80
80A
79
78
77
76
NIAGARA RIVER
NAVY ISLAND
ONTARIO
WOODS CREEK
TONAWANDA CHANNEL
GRAND ISLAND
CHIPPAWA CHANNEL
NORTH TONAWANDA
ERIE CANAL
ELLICOTT CREEK
TONAWANDA
TWO MILE CREEK
STATUTE MILE
KILOMETER
U.S.G.S. - 7.5' TONAWANDA EAST, WEST & NIAGARA FALLS QUADS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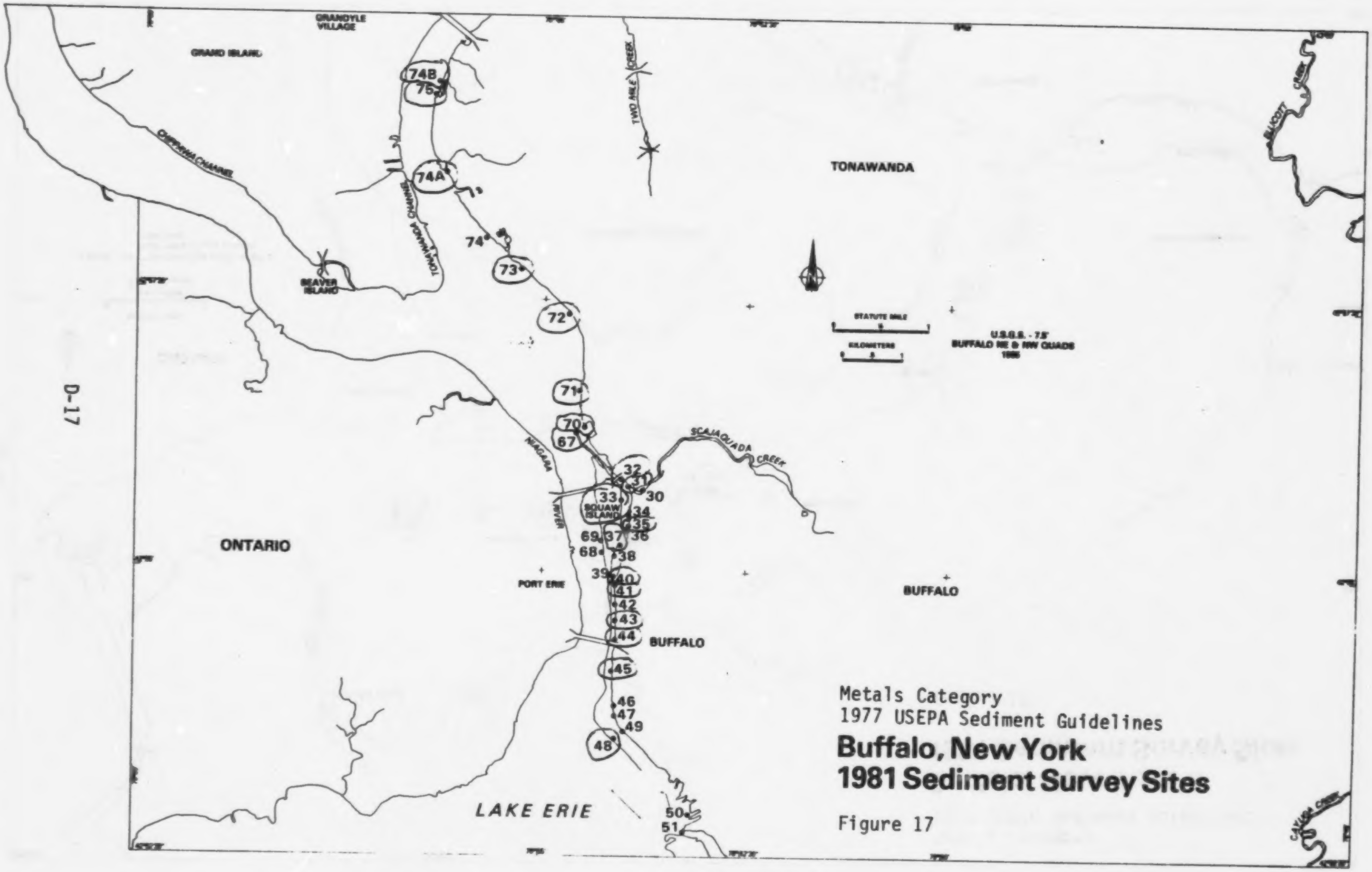
64
62
63
BUFFALO
RIVER
BUFFALO
CAYUGA CREEK
BUFFALO CREEK
CAZENOVIA CREEK
SMOKE CREEK
STP
STP
LAKE ERIE
STATUTE MILE
0
1
KILOMETERS
0
.5
1
U.S.G.S. - 7.5'
BUFFALO-SE-QUAD
78°52'30"
42°52'30"
78°50'
42°52'30"
42°50'
42°50'
42°47'30"
42°47'30"
78°52'30"
78°50'

Metals Category
1977 USEPA Sediment Guidelines

Buffalo, New York
1981 Sediment Survey Sites

Figure 16


GRAND ISLAND
GRANDYLE VILLAGE
CHIPPAWA CHANNEL
BEAVER ISLAND
TONAWANDA CHANNEL
TWO MILE CREEK
TONAWANDA
STATUTE MILE
KILOMETERS
U.S.G.S. - 7.5'
BUFFALO NE & NW QUADS
ONTARIO
NIAGARA RIVER
SCAJAQUADA CREEK
SQUAW ISLAND
PORT ERIE
BUFFALO
BUFFALO
LAKE ERIE
ELLICOTT CREEK
CAYUGA CREEK
74B
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74A
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48
50
51

Metals Category
1977 USEPA Sediment Guidelines

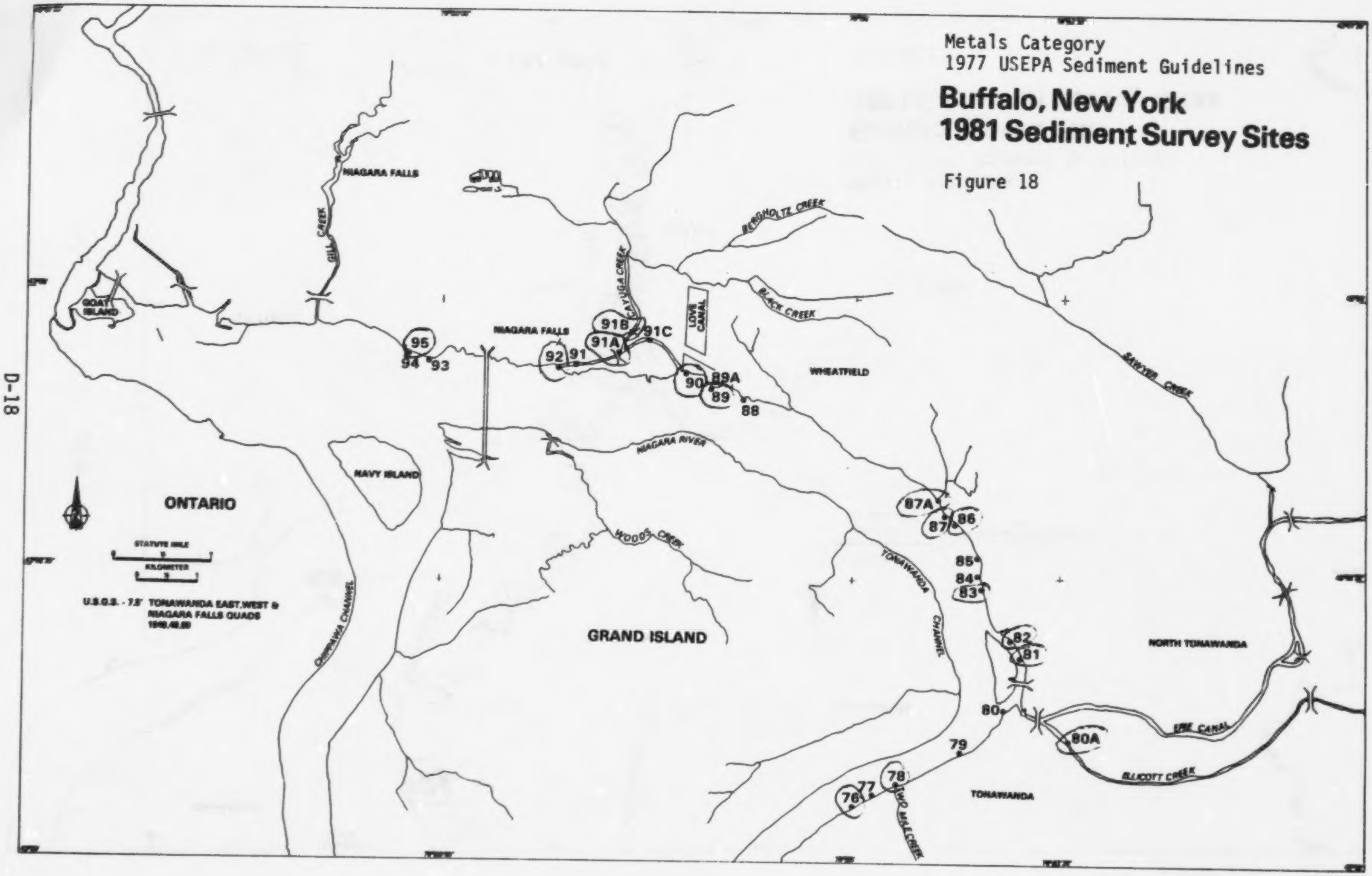
Buffalo, New York
1981 Sediment Survey Sites

Figure 17

Metals Category
1977 USEPA Sediment Guidelines

Buffalo, New York
1981 Sediment Survey Sites

Figure 18


GOAT ISLAND
NIAGARA FALLS
GILL CREEK
95
94
93
NIAGARA FALLS
92
91
91B
91A
91C
CAYUGA CREEK
LOVE CANAL
90
89A
89
88
BERGHOLTZ CREEK
BLACK CREEK
WHEATFIELD
SAWYER CREEK
NIAGARA RIVER
NAVY ISLAND
ONTARIO
WOODS CREEK
GRAND ISLAND
CHIPPAWA CHANNEL
TONAWANDA CHANNEL
87A
87
86
85
84
83
82
81
80
80A
79
78
77
76
TWO MILE CREEK
NORTH TONAWANDA
TONAWANDA
ERIE CANAL
ELLICOTT CREEK
STATUTE MILE
KILOMETER
U.S.G.S. - 7.5' TONAWANDA EAST,WEST & NIAGARA FALLS QUADS

APPENDIX E

Compounds Identified as Greater Than 5 ppm Correlated With Station Sites

Organic Compounds Exceeding 5 ppm

I. Alcohols, Organic Acids, Ethers and Esters

	Sample Sites
Alcohols	
alcohols, misc.	11
Organic Acids	
phenylacetic acid	01
tetradecanoic acid	43
hexadecanoic acid	41
Ethers	
diphenyl ether	12
Esters	
diethyl phthalate	92
di-n-butyl phthalate	16, 35, 92
bis-(2-ethylhexyl) phthalate	02, 26, 32, 33, 35, 37, 40, 41, 43, 45, 54, 72, 78, 82, 92
trimethyl ester of phosphoric acid	92

II. Chlorinated Aliphatic and Aromatic Hydrocarbons

Aliphatic	
dichloromethane	01
Aromatic	
chlorobenzene	12
dichlorobenzene	12
1,2-dichlorobenzene	12, 82, 87, 92
1,3-dichlorobenzene	92
1,4-dichlorobenzene	92
1,3- and 1,4-dichlorobenzene	12, 83
1,2,4-trichlorobenzene	12
tetrachlorobenzene	12
pentachlorobenzene	12
chlorotoluene	82

III. Aldehydes and Ketones

Ketones

	Sample Sites
4-hydroxy-4-methyl-2-pentanone (diacetone alcohol)	91A, 91B
3-hexen-2-one	87A
2,6-dimethyl-2,5-heptadien-4-one (phorone)	80A
2-methyl-2-octen-4-one	74B
4,5-dimethyl-2-cyclohexen-1-one	27, 31

Aldehydes

benzene acetaldehyde	12

IV. Napthalenes and Polycyclic Aromatic Hydrocarbons

Napthalenes

napthalene	12, 55
methylnaphthalene	31, 72
dimethylnaphthalene	10, 12, 43, 58
trimethylnaphthalene	05, 10, 11, 31, 58, 70
1,2,3-trimethyl-4-propenylnaphthalene	55
tetramethylnaphthalene	05, 10, 11
pentamethylnaphthalene	10
tert-butylnaphthalene	04
acenaphthene	05
4,9-dimethylnaphthothiophene	12, 55, 05

Polycyclic Aromatic Hydrocarbons

fluorene	12
dibenzofuran	11, 72
4-methyldibenzofuran	11
dimethyldibenzofuran	11
11 H - benzo(a)fluorene	04
fluoranthene	12, 26, 31, 32, 33, 35, 37, 40, 41, 43, 45, 52, 55, 56, 57, 58, 59, 60, 65, 67, 71, 72, 73, 74B, 78, 82, 87A, 92
methylfluoranthene	05, 57
benzo(b)fluoranthene	04, 12, 26, 45, 55, 58, 87
benzo(g,h,i)fluoranthene	04
methylbenzo(g,h,i)fluoranthene	55

	Sample Sites
Polycyclic Aromatic Hydrocarbons (cont.)	
anthracene and phenanthrene	12, 26, 31, 32, 35, 40, 41, 43, 45, 55, 56, 58, 59, 60, 71, 72, 73, 78, 82
methylanthracene	05
dimethylanthracene	31, 72
methylphenanthrene	31, 55
1-chloroanthraquinone	12
benzo(a)anthracene and chrysene	04, 12, 19, 22, 26, 27, 31, 32, 33, 35, 37, 40, 41, 43, 44, 45, 55, 56, 57, 58, 59, 60, 67, 71, 73, 74A, 75, 78, 81, 83, 86, 87A, 90, 92
methylchrysene	04
4-H-cyclopenta(d,e,f)-phenanthrene	72
pyrene	12, 26, 31, 32, 55, 56, 57, 58, 59, 60, 65, 67, 71, 72, 73, 74B, 78, 82, 87A, 92
methylpyrene	04, 05, 55
benzo(a)pyrene	12, 26, 33, 35, 37, 43, 45, 54, 55, 56, 60, 78
indeno(1,2,3-c,d)pyrene	55
benzo(g,h,i)perylene	55

V. Nitro and Amino Aromatic Hydrocarbons

Nitro

3-chloronitrobenzene	12
2,4-dichloronitrobenzene	12
2-nitrotoluene	12
4-nitrotoluene and 4-chloroaniline	12

Amino

2-aminotoluene	12

Hydrazo

1,2-diphenylhydrazine	12

Nytroso

N-nitrosodiphenylamine	12

VI. PCBs and Pesticides

	Sample Sites
PCBs	
Aroclor 1248	32, 73
Aroclor 1254	32, 73
Pesticides	
Zytron	73
hexachlorobenzene	12
o,p-DDD	12

VII. Unsubstituted Aliphatic and Aromatic Hydrocarbons

Aliphatic	
hydrocarbons, misc.	12, 19, 22, 24, 26, 27, 31, 32, 33, 40, 41, 43, 44, 45, 48, 51, 53, 54, 57, 58, 61, 66, 67, 70, 72, 73, 74A, 74B, 75, 76, 78, 81, 82, 83, 86, 87, 89, 90, 92, 95
Aromatic	
toluene	12, 43, 72

VIII. Phenols

4-(tert-butyl)phenol	73
4-(1,1,3,3-tetramethylbutyl) phenol	26, 82
picric acid	04

IX. Polyalicyclic Hydrocarbons

cholestane-3-ol	40
2,3-epoxychlolestane	40

APPENDIX F

Summary of Laboratory Methodology and Quality Control Information

Table 1
Buffalo, New York 1981 Sediment Methodology

Parameters	Units	Title/Description
Non-volatile organics: acidic & base neutrals, other organics by GC/MS	mg/kg dry weight basis	"Standard Operating Procedure for the analysis of sediments for Non-volatile Organic Compounds: Embayment and Nearshore Program CRL Method No.: "TOX105631, TOX105731" Based on USEPA Method 625 [Federal Register 1979] Sediments are air dried, sieved and soxhlet extracted with 1:1 acetone/ hexane for 16 hours. Extracts are screened by GC/FID and diluted or concentrated as needed. GC/MS protocol found in "Standard Operating Procedure GC/MS/DS Analysis of Non-Volatile Organic Compounds CRL Method No.: TOX9561, TOX9571, TOX95631, TOX95731" Compounds are quantitated against standards when available or an estimated concentration is reported on the basis of the response of the internal standard, D-10 phenanthrene.
Volatile organic by purge & trap GC/MS	ug/kg dry weight basis	"Analysis of Volatile Organic Compounds in Fish, Sediment, and Water Samples Using GC/MS, CRL Method No. TOX105631, 105731, 10561, 10571" Based on USEPA Method 624 [Federal Register 1979] Wet samples are purged with helium for 4 minutes and the organics are trapped on a Tenax trap. The trap is desorbed onto the GC column for analysis. Compounds are quantified using standards when available, or are estimated against the response of the internal standard 2-bromo-1-chloropropane.
PCBs Pesticides (GC/EC)	mg/kg dry weight basis	"Analysis of Pesticides, Phthalates, and Polychlorinated Biphenyls in Soils and Bottom Sediments, CRL Method No. PES1262-84, 17119-17125" Based on USEPA Method 608 [Federal Register 1979]. Samples are air dried, sieved and soxhlet extracted with 1:1 acetone/hexane for 16 hours. Extracts are cleaned up by Florisil column chromatography. Further separation of PCBs from Pesticides is done with silica gel column chromatography. The extracts are screened by GC/EC. Samples are quantified and confirmed by GC/EC. GC/MS analysis of the ABN extracts is used for additional confirmation.

Table 1 (Cont.)

Parameters	Units	Title Description
Ag, Al, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Li, Mn, Mo, Ni, Pb, Sn, Sr, V, Y, Zn, Ca, K, Mg, Na	mg/kg dry weight basis	"Preparation of Sediments and Other Solids for ICAP Analysis" Central Regional Laboratory, (CRL) Method #MET 413. "Standard Operative Procedure (SOP) for the Determination of Total Metals in Water by ICAP CRL Method #MET 111" Reference USEPA 1979a.
CN	mg/kg dry weight basis	"SOP for Total Cyanide, CRL Method #MIN 71919" Reference USEPA 1979b.
Phenol	mg/kg dry weight basis	"SOP: Phenols, Total Recoverable, CRL Method #MIN74818" Reference USEPA 1979b.
Ammonia as N		CRL SOP for preparation of sediment and solids for Ammonia - N, TKN, TP and COD
Sediment Sample preparation	mg/kg dry weight basis	"SOP: Ammonia Nitrogen, CRL Method #MIN 7294" Reference USEPA 1979b.
Total Phosphorus as P and Total Kjeldahl Nitrogen as N	mg/kg dry weight basis	"SOP for Total Phosphorus and Total Kjeldaahl Nitrogen, CRL Method #MIN 7315, MIN 7304," Reference USEPA 1979b.
Chemical Oxygen Demand	mg/kg dry weight basis	"SOP: COD, CRL Method #MIN 7336" Reference USEPA 1979b.
Mercury	mg/kg dry weight basis	"SOP: Total Mercury in Fish and Sediments, CRL Method #MIN 7336" Reference USEPA 1979b.
Arsenic Selenium	mg/kg dry weight basis	"SOP for the Determination of Arsenic and Selenium in Sediments and Other Solids by Furnace AA, CRL Method #MET 463, MET 4213" Reference USEPA 1979b.
Volatile Solids	% of total solids	"SOP for Total Volatile Solids (%) in Sediments and Solids, CRL Method #447" Gravimetric determination at 550°C + 50°C.
% Solids	$\frac{\%\ \text{dry weight (g)}}{\text{wet weight (g)}}$	"SOP for Total Residue (% Solids), CRL Method #444" Gravimetric determination.

Table 2

Buffalo New York 1981 Sediment Survey

Analytical Methodology Precision, Accuracy and Detection Limit Summary

Parameter	Method Code	Approx.[1] Precision	Approx.[2] Accuracy	Approx.[3] Detection Limit
Total solids	MIN45423	10%		1%
Volatile solids	MIN45524	10%		1%
COD	MIN43327	20% or 500 mg/kg	+20%	100 mg/kg
Total Kjeldahl N	MIN43025	20% or .05 mg/kg	+20%	0.05 mg/kg
Total P	MIN43126	20% or .02 mg/kg	+20%	0.02 mg/kg
Hg	MIN44728	20% or .2 mg/kg	+20%	0.1 mg/kg
phenolics	MIN44829	20% or .2 mg/kg		0.1 mg/kg
Cyanide	MIN44930	20% or .2 mg/kg	+25%	0.1 mg/kg
ICAP metals	MET 413 MET 111	20% or 2xDL	+5%	
Al				8 mg/kg
Ba				0.5 mg/kg
B				8 mg/kg
Ca				.05 g/kg
Cd				0.2 mg/kg
Cr				0.8 mg/kg
Co				0.6 mg/kg
Cu				0.6 mg/kg
Fe				8 mg/kg
Pb				7 mg/kg
Li				1 mg/kg
Mg				0.01 g/kg
Mn				0.5 mg/kg
Mo				1 mg/kg
Ni				2 mg/kg
K				0.1 g/kg
Ag				0.3 mg/kg
Na				0.1 g/kg
Sr				1 mg/kg
Sn				4 mg/kg
V				0.5 mg/kg
Zn				4 mg/kg

Table 2 (Cont.)

Buffalo New York 1981 Sediment Survey

Analytical Methodology Precision, Accuracy and Detection Limit Summary

Parameter	Method Code	Approx.[1] Precision	Approx.[2] Accuracy	Approx.[3] Detection Limit
Acid, Base, Neutral Priority Pollutants	TOX957, 959 TOX95631 TOX95731	50%	A = +30% B/N = +50% PNA = +50%	2
Pesticides, PCBs	PES1261-1284	42%[4]	53-116%	2
Volatile Priority Pollutants	TOX105631 TOX105731	15%[4]	+10%	2

Notes:
1. These are approximate values. They are statistically determined at least once a year based on duplicate analyses.
2. These are approximate values. They are statistically determined at least once a year based on spike analysis.
3. Detection limits vary depending upon sample size.
4. At analyte concentrations 3 x D.L.

Table 3
Sediment Samples
Organic Compounds Sought and Representative Detection Limits*

SEMI-VOLATILES

	Compound	Representative Maximum Detection Limit (mg/kg)
	Base-Neutral-Acid Mixtures	
1	Bis(2-chloroethyl)Ether	Less Than 2.75
2	1,3-Dichlorobenzene	" 4.25
3	1,4-Dichlorobenzene	" 6.4
4	1,2-Dichlorobenzene	" 6.4
5	Nitrobenzene	" 19.15
6	Hexachloroethane	" 3.85
7	N-Nitrosodipropylamine	" 2.1
8	Isophorone	" 1.05
9	Bis(2-Chloroethoxy)Methane	" 1.7
10	1,2,4-Trichlorobenzene	" 1.8
11	Naphthalene	" 1.5
12	Hexachlorobutadiene	" 319.5
13	2-Chloronaphthalene	" 1.25
14	Acenaphthylene	" 0.85
15	Dimethylphthalate	" 1.05
16	2,4-Dinitrotoluene	" 5.75
17	Acenaphthene	" 0.1
18	2,6-Dinitrotoluene	" 5.25
19	Fluorene	" 1.2
20	Diethylphthalate	" 2.15
21	N-Nitrosodiphenylamine	" 1.95
22	1,2-Diphenylhydrazine	" 1.7
23	4-Bromophenylpphenyl Ether	" 3.3
24	Hexachlorobenzene	" 2.3
25	Anthracene/Phenanthrene	
26	Di-N-Octylphthalate	" 3.95
27	Dibromobiphenyl	" 2.95
28	Fluoranthene	" 1.0
29	Pyrene	" 1.0
30	Butyl Benzylphthalate	" 2.4
31	Chrysene/Benz(A)Anthracene	" .5
32	Bis(2-Ethylhexyl)Phthalate	" .1
33	Benzo(B)Fluoanthene	" 5.2
34	Benzo(A)Pyrene	" 1.0
35	Indeno(1,2,3-C,D)Pyrene	" 3.35
36	Perylene	" 7.05
37	Benzo(G,H,I)Perylene	" 29.95
38	Phenol	" 95.85
39	2-Chlorophenol	" 2.9
40	2,4-Dimethylphenol	" 136.9

*(Actual Detection Limits for Individual Samples May Vary as a Function of Interferences Present, Aliquot Size, Degree of Pre-Concentration, etc.)

Table 3 (Cont.)

	Compound	Representative Maximum Detection Limit (mg/kg)	
42	2-Nitrophenol	"	4.45
43	2,4-Dichlorophenol	Less Than	3.35
44	P-T-Butylphenol	"	1.55
45	P-Chlor-M-Cresol	"	3.0
46	2,4,6-Trichlorophenol	"	4.4
47	4-Nitrophenol	"	159.75
48	4,6-Dinitro-Ortho Cresol	"	38.35
49	Pentachlorophenol	"	41.65
	Pesticides		
1	Triflan(Trifluralin)	Less Than	21.8
2	Gama-BHC (Lindane)	"	5.15
3	Hexachlorobenzene	"	1.8
4	2,4 D-Isopropyl Ester	"	8.0
5	Beta-BHC	"	12.8
6	Alpha-BHC	"	18.8
7	Heptachlor	"	7.2
8	N-Butylphthalate	"	.05
9	Zytron	"	2.75
10	Aldrin	"	7.05
11	DCPA	"	1.9
12	Isodrin	"	7.1
13	Heptachlor Epoxide	"	5.05
14	Oxychlordane	"	23.95
15	Gamma Chlordane	"	4.3
16	o,p-DDE	"	1.9
17	Endosulfan-I	"	29.95
18	p,p-DDE	"	2.55
19	Dieldrin	"	5.56
20	o,p-DDD	"	1.2
21	Endrin	"	22.6
22	Chlorobenzilate	"	1.8
23	Endosulfan-II	"	123.4
24	o,p-DDT & p,p-DDD	"	1.0
25	Kepone(Chlordecone)	"	6.55
26	p,p-DDT	"	6.45
27	Methoxychlor	"	4.05
28	Tetradifon	"	17.55
29	Mirex	"	3.55
	Araclor Mixture 1242, 1248, 125		
1	Dichlorobiphenyl(1)	Less Than	2.45
2	Dichlorobiphenyl(2)	"	3.0
3	Trichlorobiphenyl(1)	"	2.65
4	Trichlorobiphenyl(2)	"	1.95
5	Trichlorobiphenyl(3)	"	4.55

Table 3 (Cont.)

	Compound	Representative Maximum Detection Limit (mg/kg)	
6	Tetrachlorobiphenyl(1)	Less Than	2.9
7	Tetrachlorobiphenyl(2)	"	3.65
8	Tetrachlorobiphenyl(3)	"	2.6
9	Tetrachlorobiphenyl(4)	"	3.7
10	Tetrachlorobiphenyl(5)	"	.2
11	Pentachlorobiphenyl(1)	"	5.5
12	Pentachlorobiphenyl(2)	"	15.2
13	Pentachlorobiphenyl(3)	"	9.05
14	Pentachlorobiphenyl(4)	"	8.2
15	Hexachlorobiphenyl(1)	"	7.75
16	Hexachlorobiphenyl(2)	"	9.05
17	Hexachlorobiphenyl(3)	"	4.6
18	Heptachlorobiphenyl(1)	"	7.2
19	Heptachlorobiphenyl(2)	"	7
1	Dichloromethane	Less Than	.0023
2	Trichlorofluoromethane	"	.0041
3	1,1-Dichloroethylene	"	.0027
4	1,1-Dichloroethane	"	.0037
5	1,2-Dichloroethylene	"	.0089
6	Trichloromethane	"	.0139
7	1,2-Dichloroethane	"	.0016
8	1,1,1-Trichloroethane	"	.0010
9	Tetrachloromethane	"	.0014
10	Bromodichloromethane	"	.0006
11	1,2-Dichloropropane	"	.0016
12	1,3-Dichloro-1-Propene (Trans)	"	.0013
13	Trichloroethylene	"	.0012
14	Benzene	"	.0007
15	Dibromochloromethane	"	.0007
16	1,1,2-Trichloroethane	"	.0016
17	1,3-Dichloro-1-Propene (Cis)	"	.0023
18	Tribromomethane	"	.0037
19	1,1,2,2-Tetrachloroethane	"	.0011
20	Tetrachloroethylene	"	.0091
21	Methylbenzene	"	.0026
22	Chlorobenzene	"	.0028
23	Ethylbenzene	"	.0004
24	1,3-Dimethylbenzene	"	.0005
25	1,2- & 1,4-Dimethyl Benzene	"	.0029

SEDIMENTS ANALYSIS
(Pesticides, PCBs, Acids, Base, Neutrals)

Sample Extract Preparation

See Flow Sheet (Appendix F, Figure 1)

I. PESTICIDES/PCB ANALYSIS BY DUAL COLUMN GC/EC

For the pesticides one has an analytical column and a confirmatory column. The same is true for the PCBs. In the procedure, the pesticide analytical column serves as the PCB confirmatory column and the PCB analytical column serves as the pesticide confirmatory column. WITHOUT CONFIRMATION OF THE RESULTS OF THE ANALYTICAL COLUMN, ONE CANNOT SAY THAT A PARTICULAR COMPOUND IS PRESENT IN THE SAMPLE EXTRACT.

1. GC/EC Screen

   Purpose: To get information from the scans such that proper concentration adjustments may be made such that the amounts that the EC detector see are in range of the standards used.

2. GC/EC Scan

   a. Calibration Run - Use Reference Standards

      Purposes:

      i. To note any changes in column resolution

      ii. To note any changes in detector response

      iii. To obtain Relative Response Factors for the Internal Standard Method used for Quantitation of Fractions "D" and "F"

      iv. To obtain Area Response Factors for the External Standard Method used for Quantitation of Fraction "E"

   b. Sample Scans: also includes a method blank, spike, and duplicate

3. Data Reduction and Compilation

4. Report: expressed in MG/KG (Dry weight basis)

II. SEMIVOLATILES ANALYSIS BY CAPILLARY GC/MS

Semivolatiles = Acids, Base, Neutrals

Capillary: Fused Silica, SE-54   Mass Range: 45 -- 450 amu

Quantitation Method: D-10 Phenanthrene as Internal Standard

1. Preliminary Requirements before scans may be run

   Autotune and Decafluorotriphenyl Phosphine

2. GC/MS Scans

   acquire raw data for the Standards, method blank, samples, duplicate and spike

3. Data Reduction

   a. Edit, if necessary, the "ID" files for those compounds for which we have reference standards and routinely analyze

The information in the ID files include the following:

Compound #
Chemical Name:
Spectrum #:
Relative Retention Time:
Relative Response Factor:
Concentration:

ION	MASS	%AREA
1	188	100
2	189	16
3	184	16

$$\text{Relative Retention Time (RRT)} = \frac{\text{Retention Time of Compound}}{\text{Retention Time of ISTD}}$$

$$\text{Relative Response Factor (RRF)} = \frac{\text{(Amount ISTD)(Area Response Compound)}}{\text{(Amount Compound)(Area Response ISTD)}}$$

The above data is necessary to run the QUANTID programs on the three Quantid Lists which we have (Acid, Base/Neutrals, Pesticides, PCBs). Requirements for Quantid hits.

   b. Reconstructed Total Ion Current Scan (RIC)

      i. Find, confirm and obtain mass spectra for Quantid hits

      ii. Examine RIC for unknowns

         a. Library search each unknown peak for "tentative" identifications. Document identifications (Scan MS and Library MS).

         b. Hydrocarbons are aliphatic hyrdrocarbons and their amounts summed.

         c. Unknowns are reported with their Scan #.

c. Concentration Estimation of "Tentative" and Unknowns

Use QUAN 3 program

Assumption made: RRF of compound = 1

$$\text{Concentration (mg/kg)} = \frac{(\text{Area of Compound})(\text{Amount of ISTD})}{(\text{Area of ISTD})(\text{RRF})(\text{Sample Size in KG})}$$

d. Report: expressed in mg/kg (Dry weight bases)

III. VOLATILES ANALYSIS BY PURGE AND TRAP GC/MS

Analysis is performed on a separate portion of the original sediment sample.
Sequence of Events

1. Preliminary Requirements before any scans may be run
   Autotune and Bromofluorobenzene
   Mass Range: 45 -- 300 amu
   Quantitation Method: 2-Bromo-1-chloropropane as Internal Standard

2. GC/MS Scans

   acquire raw data for the Standard, method blank, samples, duplicate

3. Data Reduction: See above

Figure 1

FLOW SHEET Sediment - Nearshore Program Ground, Sieved Sediment

1) Soxhlet Extraction, 16 hrs. Acetone/Hexane 1:1 (200 ml)
2) Concentrate Extract and Solvent Exchange

50% ← Crude Extract → 50%

GC/FID Screen
↓
GC/MS* Semi-Volatile Organics Analysis
↓
Acid, Base, Neutrals
+
Pesticide/PCB Confirmation

Column Chromatography

Florisil
6% Ether/Hexane
50% Ether/Hexane

"C" + "D" (Pesticides)

Silica Gel
1) Hexane
2) 20% Ether/Benzene

"E" (PCBs) + "F"

Fractions D, E, F are
1) Screened by GC/EC*** to put in range of standards
2) Scanned by GC/EC

GC/MS** Volatile Organic Analysis is done by Purge/Trap method using Tekmar + GC/MS

Weighed Wet Sediment

% Solids From Inorganic Section

He purged onto Tenax trap

Trapped Volatiles

180-200°C vapors swept to head of column where GC/MS run starts

All samples are analyzed by GC/EC, GC/MS and GC/MS-VOA

*GC/MS uses capillary column, SE-54 fused silica for semi-volatile organics analysis

**GC/MS uses a packed column of 1% SP-1000/Carbopack B - 8 foot in length & 2 mm interior diameter - for volatile organics analysis

***GC/EC Analysis uses a dual column method - packed columns - 8 foot in length and 2 mm interior diameter

1) PCB Column: 3% SP-2100
2) Pesticide Column: 1.5% SP-2250/1.95% SP-2401

DATA SET

CALCULATION FOR BETA-BHC VALUES IN SAMPLES AND USING THE INTERNAL STANDARD ISTD) PROCEDURE (REF. Hewlett Packard 3354 Computer Data System)

$$\text{Response Factor}_{\text{ISTD}} = (\text{Micrograms}_{\text{ISTD}}) / (\text{Peak Area}_{\text{ISTD}})$$

$$\text{Response Factor}_{\text{COMPD}} = (\text{Micrograms}_{\text{COMPD}}) / (\text{Peak Area}_{\text{COMPD}})$$

where COMPD = Compound Analyzed (Beta-BHC)

$$\text{Relative Response Factor} = \text{Response Factor}_{\text{COMPD}} / \text{Response Factor}_{\text{ISTD}}$$

$$= (\text{Micrograms}_{\text{COMPD}} / \text{Peak Area}_{\text{COMPD}}) / (\text{Micrograms}_{\text{ISTD}} / \text{Peak Area}_{\text{ISTD}})$$

$$= \frac{(0.019/20361)}{(1/100395)} = 0.093684$$

$$C_{\text{COMPD}} = \frac{\text{Peak Area}_{\text{COMPD}} \text{ X Relative Response Factor}_{\text{COMPD}} \text{ X STD. AMT. X D}}{\text{Peak Area}_{\text{ISTD}} \text{ X Relative Response Factor}_{\text{ISTD}} \text{ X SAMPLE AMT. X 100}}$$

where C = Concentration (Micrograms/Gram)
RRF = Relative Response Factor
D = % Dilution Factor obtained by multiplying the final volume of the sample extract by 100

$$C_1 = \frac{99021 \times 0.093684 \times 1 \text{ microgram/ml} \times 15000 \text{ mls}}{92672 \times 1 \times 10 \text{ grams} \times 100} = 1.502 \text{ micrograms/gram}$$

$$C_2 = \frac{66694 \times 0.093684 \times 1 \text{ microgram/} \times 15000 \text{ mls}}{104205 \times 1 \times 10 \text{ grams} \times 100} = 0.899 \text{ micrograms/gram}$$

NOTE: The numbers for the calculation of the Relative Response Factor come from the calibration run of the standards.

CONSTITUENTS IN THE DIFFERENT FRACTIONS

FRACTION D

Mirex*
Methoxychlor*
DCPA
Dieldrin
Endrin
Endosulfans

FRACTION E

Hexachlorobenzene*
Heptachlor
Aldrin
Mirex*
Aroclors 1242, 1248, 1254, 1260

FRACTION F

Hexachlorobenzene*
Lindane
beta-BHC
Zytron
Heptachlor Epoxide
gamma-Chlordane
o,p'-DDE
p,p'-DDE
o,p'-DDD
o,p'-DDT
p,p'-DDD
p,p'-DDT
Oxychlordane
Methoxychlor*

* Denotes that the particular compound is present in more than one fraction

DUAL COLUMN GC/EC COMPOUND CONFIRMATION
FRACTION "F"

PESTICIDE ANALYTICAL COLUMN (1.5%SP-2250/1.95%SP-2401)

Compound	Ret. Time
Trifluralin	1.72 min
Hexachlorobenzene	1.95 "
gamma-BHC (Lindane)	2.61 "
beta-BHC	2.97 "
Zytron	4.56 "
Oxychlordane	5.14 "
Heptachlor Epoxide	5.64 "
gamma-Chlordane	6.26 "
o,p'-DDE	6.70 "
p,p'-DDE	8.16 "
o,p'-DDD	9.59 "
o,p'-DDT	11.44 "
p,p'-DDD	12.46 "
p,p'-DDT	14.97 "
Mirex (ISTD)	22.70 "
Methoxychlor	28.73 "

PESTICIDE CONFIRMATION COLUMN (3%SP-2100)

Compound	Ret. Time
Hexachlorobenzene	3.31 min
Trifluralin	3.64 "
gamma-BHC/beta-BHC	3.90 "
Zytron	7.19 "
Oxychlordane/ Heptachlor Epoxide	9.16 "
gamma-Chlordane/ o,p'-DDE	10.01 "
p,p'-DDE	12.26 "
o,p'-DDD	13.06 "
p,p'-DDD/o,p'-DDT	16.55 "
p,p'-DDT	20.64 "
Methoxychlor	30.35 "
Mirex (ISTD)	33.64 "

ISTD = Internal Standard

APPENDIX G

Summary, by Category, of Compounds, Their Production Method and Uses for Compounds Found at Concentrations Greater Than 5 ppm

Alcohols, Organic Acids, Ethers and Esters

Compound	Production	Use
alcohols, misc.	--------	solvents
tetradecanoic acid	hydrolysis of lipids	soaps
hexadecanoic acid	hydrolysis of lipids	soaps
phenylacetic acid	oxidation of phenyl ethyl alcohol	perfumery
diphenyl ether	condensation of phenol	heat transfer, perfuming soaps, chemical intermediate
diethylphthalate	esterfication of phthalic acid	solvent, fixative
di-n-butyl phthalate	esterfication of phthalic acid	insect repellent
bis-(2-ethylhexyl) phthalate	esterfication of phthalic acid	plasticizer
trimethyl ester of phosphoric acid	esterfication of phosphoric acid	fire retardant

Chlorinated Aliphatic and Aromatic Hydrocarbons

All compounds in this group are produced by successive chlorinations of an organic starting material. Uses of those compounds are as follows:

Compound	Use
chlorobenzene	solvent, chloronitrobenzene intermediate
1,2-dichlorobenzene	toluene diisocyanate process solvent
1,4-dichlorobenzene	mothballs, room deodorants
1,3-dichlorobenzene	-----
1,2,4-trichlorobenzene	solvent, dye carrier
1,2,4,5-tetrachlorobenzene	chemical intermediate
pentachlorobenzene	pentachloronitrobenzene intermediate
2-chloronaphthalene	dielectric, dye solvent
dichloromethane	cellulose acetate solvent, degreasing and cleaning fluids

Summary of Aldehydes and Ketones

Compounds	Production	Use
diacetone alcohol	acetone condensation	solvent
phorone	byproduct of diacetone alcohol, isophorone	---
4,5-dimethyl-2-cyclohexen-1-one	byproduct of isophorone	---
3-hexen-2-one	acetone/propionaldehyde condensation	---
2-methyl-2-octen-4-one	acetone/hexanone condensation	---
phenylacetaldehyde	nitric oxide oxidation of phenylethyl alcohol	perfumery

Naphthalene and Polycyclic Aromatic Hydrocarbons

All of the naphthalenes are production of coal tar and can be produced by the incomplete combustion of coal. Naphthalene is used industrially to manufacture phthalic acid (by oxidation). Naphthalene is widely used as a starting material for various dye intermediates. Naphthalene has also found some use as a solvent and lubricant. All of the other naphthalenes have very limited or no industrial significance.

Compound

naphthalene

methylnaphthalene
dimethylnaphthalene
trimethylnaphthalene
1,2,3-trimethyl-4-propenylnaphthalene
tetramethylnaphthalene
pentamethylnaphthalene
tert-butylnaphthalene

acenaphthene

Polycyclic aromatic hydrocarbons are also produced as a result of the incomplete combustion of coal. These compounds have no industrial significance, except for 1-chloroanthraquinone, used in dye manufacture.

Compound

fluorene

dibenzofuran

4-methyldibenzofuran
dimethyldibenzofuran

11 H - benzo(a)fluorene

fluoranthene

methylfluoranthene

benzo(b)fluoranthene

benzo(g,h,i)fluoranthene

methylbenzo(g,h,i)fluoranthene

anthracene and phenanthrene

methylanthracene
methylphenanthrene
dimethylphenanthrene

1-chloroanthraquinone

benzo(a)anthrancene and chrysene

methylchrysene

4 H -cyclopenta(d,e,f)phenanthrene

pyrene

methylpyrene

benzo(a)pyrene

indeno(1,2,3-cd)pyrene
benzo(g,h,i)perylene

Nitro, Nitroso, and Amino Aromatic Hydrocarbons

Compound	Production	Use
nitroaromatics chloronitroaromatics aminonitroaromatics chloroaminoaromatics	combinations of nitration, amination or (nitro) reduction, and chlorination reactions	dye intermediate
1,2-diphenylhydrazine	reduction of nitrobenzene	dye intermediate
N-nitrosodiphenylamine	nitrosation of diphenylamine	impurity in azo dyes

PCBs and Pesticides

Compound	Products	Use
Aroclor 1248	chlorination of biphenyl	dielectric in transformers, hydraulic fluid solvent
Aroclor 1254	chlorination of biphenyl	dielectric in transformers, hydraulic fluid solvent
Zytron	1) methanol and dichlorophenol esterfication of phosphoric acid 2) amidization with isopropylamine through the acid chloride	herbicide
p,p-DDD	Condensation of chlorobenzene with dichloroacetaldehyde or breakdown product of DDT	insecticide

hydrocarbons, misc.

This group most likely consists of branched and unbranched alkanes found in petroleum refinery cuts, such as gasoline, kerosene, and fuel oils. These compounds are obtained by cracking and/or alkalation processes carried out on crude petroleum.

toluene

Toluene can be obtained from natural sources such as petroleum or coal tar. It can also be produced from alkanes by catalytic reforming. Toluene is used as a solvent and as an organic chemical starting material for producing a wide variety of products.

Phenols

Compounds	Production	Use
4-(tert-butyl)phenol	alkylation of phenol	intermediate, deemulsifier, oil additive
4-(1,1,3,3,-tetramethylbutyl) phenol	alkylation of phenol	nonionic detergent manufacture
picric acid	mixed acid nitration of phenol sulfonates	explosives

cholestane-3-ol, and 2,3-epoxycholestane, are related to cholesterol: Cholestane-3-ol and 2,3-epoxycholestane are cholesterol derivatives found in human waste. These compounds indicate the presence of untreated sewage.